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A Review of the Species of Lycopodium of North America

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(WITH PLATES 2, 3, AND 4.)

The genus *Lycopodium* as represented in North America has never received a careful revision. Various forms, mostly varietal, have been described from time to time but the treatment in the various manuals has been mainly that accepted by European writers, commencing with Linnaeus and closing with Milde. Meanwhile a large amount of material has accumulated and we are in the position to give the genus a preliminary survey and bring our knowledge of the American species up to the datum line of modern collections. Much still remains to be done to clear up certain outlying forms and limit the range and variations of certain species and, if possible, determine the causes involved.

The genus *Lycopodium* as treated by Baker * includes ninety-four species and this may be regarded as a very conservative estimate of its extent. Certain features of the range of species are of interest. Five species are circumboreal and are distributed more or less widely throughout the North Temperate Zone. Europe has seven species, viz, *L. Selago*, *inundatum*, *annotinum*, *clavatum*, *alpinum*, *complanatum*, and *chamaecyparissus*, all but the second and last being circumboreal and all being found in North America.

In extratropical North America, Baker recognized ten species. To these six must be added, of which three are here recognized as species for the first time. *L. cernuum*, a widely distributed

* Handbook of Fern Allies, 1887.

tropical species, also enters our Gulf States. To these Mexico adds seven species, of which *L. serratum*, originally described from Japan, is very doubtfully Mexican, and the rest are species of the West Indies. These islands add six more, of which *L. rigidum* is endemic and the others are species of wider range through tropical America. South America has some forty-one species, of which twenty-nine are endemic and of these twenty-one are confined to the Andean region; two are also African, two North American and the rest are neotropical.

Asia follows with twenty-six species, of which two are endemic in Japan and four in India; of the others, ten (including the five circumboreal species) are also found in the United States, nine in the East Indian Islands, and four in Polynesia. Africa has only thirteen species, of which eight are endemic; of these five are from the mountains of Madagascar. The East Indies have eighteen species, of which four are endemic; ten are species of the adjacent Asiatic mainland, and four are shared with Polynesia. Australasia has thirteen species, of which eight are endemic. Polynesia has nine species, of which only one, *L. polytrichoides*, is endemic in the Hawaiian Islands. Finally, the little island of Tristan d'Acunha has two species, both endemic.

The American species north of Mexico may be separated by the following key:

Plants with mostly upright stems with alternating zones of leaves and sporophylls (strobiles interrupted).
- Leaves hollow at their bases and appressed. 1. *L. Selago.*
- Leaves flattened at their bases and ultimately more or less reflexed.
  - Leaves linear or nearly so, entire or very minutely denticulate. 2. *L. porophilum.*
  - Leaves distinctly broadest above the middle and erose. 3. *L. lucidulum.*

Plants with more or less extended horizontal stems; the sporophylls aggregated into terminal strobiles.
- Sporangia subglobose; sporophylls similar to the foliar leaves.
  - Sporophylls short (5–6 mm.).
    - Sporophylls deltoid, mostly entire; plants small. 4. *L. inundatum.*
    - Sporophylls contracted above the base with a few teeth; plants large. 5. *L. adpressum.*
  - Sporophylls longer (8–10 mm.), usually much toothed.
    - Leaves in many rows, radially arranged; stems arching. 6. *L. alopecuroides.*

Leaves arranged so as to lie in nearly one plane; stems pinnately branching, prostrate. 7. *L. pinnatum.*

Sporangia transversely compressed, reniform; sporophylls entirely unlike the foliar leaves.

Leafy stems short (2–15 cm.), prostrate, leaves lying nearly in one plane, none beneath. 8. *L. Carolinianum.*

Stems with abundant erect or ascending leafy branches.

Leaves equal, radially arranged (except on the terminal branches of no. 11) in five or more rows.

Aerial portions dendroid.

Strobiles few, stout, erect. 11. *L. obscurum.*

Strobiles numerous, short, nodding. 12. *L. cernuum.*

Aerial portions extensively trailing, with clustered branches.

Leaves in five rows; stems and branches slender (2 mm.). 13. *L. Sitchense.*

Leaves in more than five rows.

Strobiles solitary, sessile. 9. *L. annotium.*

Strobiles 1–several on evident elongate peduncles. 10. *L. clavatum.*

Leaves in four rows on flattened aerial dorsiventral stems.

Branches convex on both sides; leaves alike in all four rows. 14. *L. sabinaefolium.*

Branches with under surface flat or concave.

Strobiles pedunculate, peduncles usually forked twice.

Leaves of under row scarcely reduced; terminal. 15. *L. chamaecyparissus.*

Leaves of under row much reduced to a subulate tip; terminal branches spreading, horizontally fan-shaped. 16. *L. complanatum.*

Strobiles sessile upon stronger leafy branches; leaves of the under row trowel-shaped. 17. *L. alpinum.*

1. L. SELAGO L. Sp. Pl. 1102. 1753

Prostrate portion of stem very short, abundantly rooting, soon curving upward and dichotomously branching to form compact tufts (4–17 cm. high) of vertically placed branches with dense foliage: leaves more or less appressed, or at least upwardly directed, triangular (1.5 × 4 mm.) to linear-acuminate (0.5 mm. × 5 mm.) or aciculate (1 mm. × 8 mm.), broadest at the hollow base, gradually tapering to the acuminate apex, entire: sporophylls shorter than the leaves, triangular: sporangia reniform: plant very frequently gemmiparous.

A boreal and arctic plant, showing a considerable degree of variability. Alaskan material shows a range of variation in its leaves which measure from 2 × 4 mm. to 1 × 8 mm., and this in the same habitat, judging from a series of specimens collected by Thos.

Howell, at Yes Bay, Aug. 21, 1895 (N), and another in the same locality Aug. 26, 1895, by M. W. Gorman. Slender-leaved material comes also from Kadiak Is. (B. J. Bretherton, July 23, 1894).

Specimens from the Cascade Mts., Washington, Macdonald Lake, Montana, and Twin Lakes show but little differences, the leaves ranging from 1.5 × 4–8 mm. to 0.8 mm. × 5 mm. Specimens from the Northeast, show considerable variation. The forms with the most slender leaves come from the mountains of Vermont, growing in a moist, shaded habitat (A. J. Grout, Mt. Mansfield). These facts, together with the variability found in the moist climate off the Alaskan coast, would indicate that the slender form of the leaf is induced by a wet, shaded habitat.

Other specimens collected by Dr. Grout, at Mt. Mansfield, whether in the shade or not is not stated, have somewhat broader leaves. Plants of Mr. G. G. Hinsdale's collection of the "summit of Mt. Mansfield" (1893) are typical in form, with shorter and broader leaves.

Distribution: Greenland, Labrador, Newfoundland, Maine, New Hampshire, Vermont, New York, North Carolina, Idaho, Washington, Alaska, St. George Island (Behring Sea). A plant with strongly reflexed leaves but otherwise not differing from *L. Selago* is represented by specimens as follows:

IDAHO: Little North Fork Basin "mountain woods," Sept., 1895, J. B. Leiberg (N).

ALASKA: Sitka, F. Bischoff (N).

CANADA: Mud Lake, July, 1891, F. F. Wood (N).

2. **L. porophilum** sp. nov.

Prostrate portion of stems short, abundantly rooting, curving upwards, then dichotomously branching 1–3 times to form a rather dense tuft (4–10 cm. high) of vertical stems, densely clothed with spreading or reflexed leaves: leaves (7–9 mm. × 1 mm.) very slightly broadened above the middle and similarly contracted toward the base, those between the strobilar regions shorter (6–7 mm.), broadest at the base but very gradually tapering, entire or very minutely denticulate: sporangia compressed reniform: sporophylls minutely denticulate above the middle or entire, acuminate (4–5 mm. × 1 mm. wide at base): plant often gemmiparous.

A plant intermediate in habit between *L. lucidulum* and *L. Selago*,

having the leaves spreading or somewhat reflexed, with the alternation of long leaves and short sporophylls. Leaves not hollow at the base but flat as in *L. lucidulum*.

Of very limited range so far as known at present, and confined apparently to sandstone rocks. The plant varies no more than *L. lucidulum*, both differing in this respect from *L. Selago*.

INDIANA: Fern, Putnam Co., Oct., 1891,* L. M. Underwood (U): type.

WISCONSIN: Dells of the Wisconsin, Aug. 19, 1893, L. M. Underwood (U).

KENTUCKY: Mountains, Warren Co., "on the face of sandstone cliffs, June, 1898," S. F. Price (U). Green River, Warren Co., "on a sandstone cliff," June, 1896, S. F. Price (U).

ALABAMA: Winston Co. "under projecting sandstone rocks near Sipsey River," 1 June, 1896, L. M. Underwood (U). This plant differs slightly from the other and more northerly ones in having narrower sporangia.

3. L. LUCIDULUM Michx. Fl. Bor. Am. **2**: 284. 1803

Prostate portion of stems longer (5–15 cm.), frequently rooting, curving upward and dichotomously branching 1–3 times to form a loose cluster (10–20 cm. high) of a few densely leafy vertical stems, or the stems occasionally occur single: leaves reflexed (8–11 mm. × 1.5–2 mm.), linear-obovate, broadest above the middle, from which point they gradually taper to the 1 mm. wide base; margin erose denticulate above the middle, acute: sporophylls 3.5–8.5 mm. × 1.2–1.5 mm., linear, acute, entire or sometimes slightly denticulate: sporangia depressed reniform: plant often gemmiparous.

The rhythmic production of sporangia and the resulting alternation of long leaves and short sporophylls gives the foliage a wavy outline quite characteristic of this plant, with its shining dark green leaves.

Habitat in forests, more commonly in low ground.

Distribution: Newfoundland, Prince Edward Island, New Brunswick, Maine, New Hampshire, Vermont, Ontario, Massachu-

* At the Indiana station this species grows with *L. lucidulum*, the latter always in the low swampy ground bordering the small streams, while this species grows along the narrow ledges of the overhanging sandstone rocks. The range of *L. lucidulum* also includes the other stations.

setts, Connecticut, New York, New Jersey, Pennsylvania Maryland, Virginia, West Virginia, Tennessee, North Carolina, South Carolina, Indiana, Illinois, Missouri, Minnesota, Michigan, Wisconsin.

4. L. INUNDATUM L. Sp. Pl. 1102. 1753

Stems creeping horizontally or arching, about 10 cm. long, simple or once or twice forking, slender, 1.5 mm. in diameter, roots produced toward the end of the annual growth: leaves 5 mm. × 0.8 mm. linear-lanceolate, entire, acute, curved upward; those of the peduncles straight, entire, more slender and tapering: peduncles 0.5–6 cm. long or the strobiles sessile: strobiles 0.8–4 cm. long: sporophylls about 5–6 mm. long, 1.5 mm. wide at the base, triangular, usually entire or sometimes toothed just above the base, then somewhat contracted: sporangia subglobose. European material shows denticulation of the sporophylls.

Specimens have been examined as follows:

NEWFOUNDLAND: Bally Haily Bog, St. John, Aug., 1894, B. L. Robinson and H. von Schrenk, no. 135 (N, G).*

NOVA SCOTIA: July, 1884, H. T. Meenan (G).

PRINCE EDWARD ISLAND: 1888, J. Macoun (G).

CAPE BRETON ISLAND: July, 1883, J. Macoun (G).

NEW BRUNSWICK: 1868, J. Fowler (G); Bass River, "rare," Oct., 1875, J. Fowler (N).

MAINE: Bog, Great Cranberry Isle, Sept. 1891, E. L. Rand (U); Mount Desert Island, Sept., 1890, E. L. Rand (U); Dead River, M. L. Fernald, 497 (G); Oxford Co., J. A. Allen (G, N).

ONTARIO: Hastings Co., July, 1876, J. Macoun (C).

NEW HAMPSHIRE: Mt. Willey, Aug., 1878 (Y); White Mts., E. Tuckerman (C, G); Seabrook, Sept., 1895, A. A. Eaton (N).

VERMONT: Hartland, Sept., 1893, W. W. Eggleston (C).

CONNECTICUT: Southington, Sept., 1898, C. H. Bissell (Y).

MASSACHUSETTS: Berkshire Co., July, 1890, A. K. Harrison (U); South Hadley, Oct., 1888, Alice Carter (U); Sudbury, Nov., 1890, L. M. Underwood (U).

NEW JERSEY: C. F. Austin (U).

PENNSYLVANIA: Luzerne Co., Sept., 1890. Small and Heller

* The letters N, G, C, Y, and U, refer to the National, Gray, Columbia, New York Botanical Garden, and Underwood herbaria in which the specimen cited may be found.

(N); Pocono Mt., T. Green (G); Tobyhanna, July, 1889, N. L. Britton (C).

NEW YORK: Herkimer Co., J. A. Paine (G).

ILLINOIS: Evanston, 1884, H. L. Boltwood (G).

MICHIGAN: Keeweenah Co., 1888, O. A. Farwell (G).

BRITISH COLUMBIA: Vancouver, Aug., 1893, J. Macoun (N).

ALASKA: Short Bay, July, 1895, M. W. Gorman, "wet bogs in upland meadows" (C, N); Aug., 1895, T. Howell, no. 1731 (Y).

4a. L. INUNDATUM BIGELOVII Tuck. Am. Jour. Sci. **45**: 47. 1843*

A larger plant with longer and more abundantly branching slender stems with slightly longer leaves which are entire or toothed. Sporophylls as in *L. inundatum.*

CAPE BRETON ISLAND: Peat bog, North Sidney, 1883, J. Macoun (C).

VERMONT: Stirling Mt., Aug., 1882, O. H. Butler (C); Stratton, July, 1894, A. J. Grout (U).

NOVA SCOTIA: Grand Lake, 1879, E. G. Knight (C).

MASSACHUSETTS: Ipswich, Oakes (C); New Bedford, T. A. Green (C); Plymouth, Oakes and Tuckerman (C); Tuckerman (G); Essex; Sept., 1896, A. A. Eaton (U); Oakes, "in Sphagnosis humidis Novae Angliae" (N).

RHODE ISLAND: Providence, "low, grassy land, July, 1892," J. F. Collins.

NEW JERSEY: Egg Harbor, E. G. Knight (C); Quaker Bridge, June 17, 1890, F. E. Lloyd (Y).

5. **L. adpressum** (Chapman)

L. inundatum, var. *elongatum* Chapm. Fl. So. States, ed. 2, 671. 1883. (Not *L. elongatum* Sw.)

L. inundatum, var. *adpressum* Chapm. Fl. So. States, ed. 2, 671. 1883.

L. alopecuroides var. *elongatum* Chapm. Fl. So. States, ed. 3, 638. 1897.

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* The original description reads as follows: *β Bigelovii* (mihi): majus, ramis subramosis elongatis, foliis acuminatis sparsim denticulatis s. integris. *L. Carolinianum* Bigel. Fl. Bost. p. 384.

In the same paper *L. alopecurioides* (L.) follows as the var. *γ* of *Lycopodium inundatum.*

L. alopecuroides, var. *adpressum* Chapm. Fl. So. States, ed. 3, 638. 1897.

Stems prostrate and frequently rooting or slightly arching and rooting toward the end, 18–40 cm. long, simple or occasionally pinnately branching, thick (about 3 mm. in diameter): leaves 6–7 mm. long by 2 mm. broad, thicker and more rigid than in the last, lanceolate-acuminate, upwardly curving, the margin irregularly toothed, the teeth often compound below the middle of the leaf: peduncles 10–25 cm. long usually tall, slender (1.5–2.5 mm. in diameter), leafy with more or less appressed subulate-toothed leaves below and similar entire leaves above: strobiles narrow, about 3 mm. in diameter, and 1.8–7 cm. long: sporophylls 1 mm. × 5–6 mm. with a broad base, suddenly contracted above into a narrow subulate apex, usually more or less toothed near the base: sporangia subglobose.

Readily distinguishable from *L. inundatum* by the much thicker stems, toothed leaves, tall peduncles and long narrow spikes.

An abnormal condition occurs in which the strobiles fail to develop and the branches rise to an unusual height (35 cm.). Lake Worth, Florida, L. M. Underwood (U). One peduncle on the same sheet bears a strobile of unusual size (11 cm.)

In the northern part of its range, this plant is much smaller and is difficult to distinguish from *L. inundatum Bigelovii*, from which, however, it differs in its thicker stem, in the shape of its leaves, and in the degree of their denticulation which, however, is constant in the leaves of the prostrate stems, but the constancy frequently fails in the peduncular leaves.

Although the more southern plant is here regarded as a distinct species, and is believed to be entitled to such rank, it must be admitted that from the true boreal species, *L. inundatum*, to the large southern *L. adpressum* there are many forms which on account of variations in size of stem, denticulation and variations in the size and shape of leaf and sporophyll are difficult to place. It will, however, be found convenient to hold to the above arrangement as tentative in the hope that further and more careful field observations will help to clear up the whole matter. It is further of great interest to note that a single species which in Europe shows little variability is in America only a representative of a plexus of forms ranging from that species at one end of the series to the extremely curious plant, *L. alopecuroides*, at the other.

Specimens have been examined as follows:

MASSACHUSETTS: Plum Island, Newburyport, Oct., 1896, A. A. Eaton (U); Plymouth, Oakes (C, N).

RHODE ISLAND: Providence, July, 1892, J. F. Collins (N).

CONNECTICUT: New Haven, 1859, D. C. Eaton (C).

NEW YORK: Babylon, L. I., July and Sept., 1898, W. N. Clute (Y); Forbell's Landing, L. I., Oct., 1890, M. Timmerman (C).

NEW JERSEY: Hospitality Bridge, Aug., 1884, C. A. Gross (Y); Closter, Sept., 1865, C. F. Austin (U, C); Tom's River, July, 1898, W. N. Clute (Y); Ocean Co., Aug., 1889, N. L. Britton (C).

MARYLAND: Ammendale, May, 1897, G. A. Miller (N); Anne Arundel Co., Oct., 1894, and Sept., 1895, C. E. Walters (N); Branchville, Sept., 1899, W. R. Maxon (U).

DISTRICT OF COLUMBIA: near Washington, Sept., 1885, F. H. Knowlton (U).

VIRGINIA: Portsmouth, July, 1892, N. L. and E. G. Britton and A. M. Vail (C); Fredericksburg, Aug., 1893, T. C. Porter (C).

NORTH CAROLINA: Rowan Co., J. K. Small, Aug., 1894 (N, C); Southeastern N. Car., W. W. Ashe (N).

LOUISIANA: Lake Charles, Aug., 1897, S. M. Tracy (U).

ALABAMA: L. F. Ward, 1892 (N); Mobile, 1877, C. Mohr, (N).

GEORGIA: Sumter Co., Dec., 1895 and 1896, R. M. Harper (Y).

FLORIDA: Lake Worth, Mar., 1891, L. M. Underwood (U); Leesburg, 1891, L. M. Underwood (U); Jacksonville, Mrs. F. A. Curtis (U, G); Everglades, Mar., 1892, J. H. Simpson (N, G); "L. inundatum var. elongatum, S. Fl. ined." Herb. Chapman (N) (and similar sheet in C); Palma Sola Bay, Aug., 1890, J. H. Simpson (N); among these one specimen shows an entire absence of teeth on the leaves in one region of the stem, while the rest of the specimens on the sheet have normal leaves; the specimen looks as if it had grown partly submerged.

6. **L. pinnatum** (Chapman)

L. inundatum, var. *pinnatum* Chapman, Fl. So. States, ed. 2, 671. 1883.

L. alopecuroides, var. *pinnatum* Chapman, Fl. So. States, ed. 3, 638. 1897.

Stems pinnately branching, elongate (20–30 cm.) and very slender (1–2 mm.) with evident dorsiventral character: leaves (8–9 mm. × 1 mm.) thin, linear-lanceolate, slightly curved, long-toothed, those of the upper side smaller, all somewhat contracted at the base; those of the peduncles similar but more gradually tapering to the apex: peduncles 25–40 cm. long, slender (1–2 mm. in diam.), very leafy: strobiles 3–12 cm. long, 5 mm. thick, with spreading sporophylls, similar to the peduncular leaves, but longer and more gradually tapering: sporangia sub-globose.

This very distinct species was made first a variety of *L. inundatum* and later of *L. alopecuroides*, but its dorsiventral habit and other marked characters clearly distinguish it from both; it is very clearly recognized. The lateral expanse of foliage ranges from 16 to 18 mm. Very rarely the denticulation appears to be nearly absent, as in a specimen seen from Jacksonville, Fla.

Specimens have been examined as follows:

MISSISSIPPI: Jackson, July, 1896, C. L. Pollard (N); Ocean Springs, June, 1896, L. M. Underwood (U); Aug., 1889, F. S. Earle (U); Aug., 1898, S. M. Tracy (Y).

ALABAMA: Spring Hill, Aug., 1897, B. F. Bush, 159 and 151 (Y, N); Auburn, Oct., 1896, C. F. Baker (C).

GEORGIA: McIntosh Co., June, 1895, J. K. Small (C).

FLORIDA: "Damp Pine Barrens" in Jacksonville, Sept., 1896, A. H. Curtis, nos. 3788 (C, N), 5783 (G); S. Fla., Herb. Chapman (N, C).

7. L. ALOPECUROIDES L. Sp. Pl. 1102. 1753

Stems elongate (50 cm. or more), thick (3–4 mm.), with an arching habit, rooting near the end, the vertical peduncles arising from the arches, densely leafy: leaves (5–7 mm. × 0.6–1.2 mm.) thicker than in the last, lanceolate-acuminate, spinulose on the sides of the stem to linear lanceolate on the upper and lower side, margin long toothed, and the lower surface near the base usually very hairy, especially on sides of the stem: those of the peduncles similar: peduncles long (20–30 cm.) densely leafy and scarcely distinguishable from the stems: strobiles 2–10.5 cm. long, 5 cm. thick, when ripe with reflexed sporophylls, these similar to the peduncular leaves but not hairy on the underside,

longer (10–11 mm.), more gradually tapering and similar to those of the last species.

A number of mature specimens we have seen lead us to believe that the reflexion of the sporophylls at maturity is a constant feature in this species, but not in *L. pinnatum*. Further field observations are necessary to establish or refute this belief.

Specimens have been examined as follows:

NEW YORK: Babylon, L. I., Sept., 1898, W. N. Clute (Y).

NEW JERSEY: Landisville, C. A. Gross (Y), Hospitality Bridge, Sept., 1887, C. A. Gross (N), Pines, C. F. Austin (C).

DELAWARE: Ellendale, Sept., 1891, W. M. Canby (N).

NORTH CAROLINA: Hendersonville, Sept., 1898, Biltmore Herb., 595A (Y); Wilmington "in *Dionaea* savannah," June 25, 1890, F. V. Coville (N).

SOUTH CAROLINA: Santee Canal, Sept., Ravenel (G).

MISSISSIPPI: Ocean Springs, June, 1896, L. M. Underwood (C), F. S. Earle, Aug., 1889 (U); Biloxi, Aug., 1898, S. M. Tracy (U).

ALABAMA: Spring Hill, Aug., 1897, B. F. Bush, 153 (Y N).

GEORGIA: Lowndes Co., June, 1895, J. K. Small (C); 1840, A. Gray (C).

FLORIDA: Jacksonville, "moist pine barrens," Nov., 1894, A. H. Curtis, no. 5357 (C); Lake Co., Aug., 1894, G. V. Nash (N, C); S. Fla., Chapman (N, C); Appalachicola, Aug., 1891, Chapman (N, G); Hibernia, March, 1869, W. N. Canby (G); T. W. Webster (Y).

The stems of the four species just described differ not a little in certain details of stem structure. Certain features they all possess in common with one exception, noted below; these are more especially the gum canals and air spaces which occur in the cortex. A single gum canal occurs on the outside of each leaf trace, and runs up into the leaf. The air spaces are irregular schizogenous cavities in the cortex; they are very small, are few in number in *L. inundatum* and are absent in *L. pinnatum;* in *L. adpressum* they are more numerous and larger than in *L. inundatum*, while in *L. alopecuroides* they attain their maximum development both in size and number. Indeed, the cortex in this handsome plant is little more than a honeycomb, the walls of which are com-

posed of a single layer of parenchyma cells. All four species store up toward the end of the growing season a large amount of reserve food, for the most part starch, and as a result of this habit the terminal portions of their horizontal stems become considerably thickened. The stele is also enlarged in these parts, and the air spaces are very much reduced, more so in *L. alopecuroides*, however, than in the others. These terminal parts of the stems serve to perpetuate the plants during the winter. There is also not a little difference in the size of the stems, *L. pinnatum* having the smallest, with *L. inundatum* next in order; *L. alopecuroides* has the thickest stem of the four.

8. L. CAROLINIANUM L. Sp. Pl. 1104. 1753

Stems short (1–15 cm.), slender (1–1.5 mm. diam.), prostrate, pinnately branching, rooting occasionally from the under side; leaves strongly dimorphic, the apparently lateral ones large (5–6 mm. × 1.5–2 mm.), ovate-lanceolate, falcate, recurved, broadest below the middle, with a midrib asymmetrically placed, thin, entire, acute: leaves of the upper side smaller (3–4 mm. × 0.8–1 mm.), subulate with a broad base: leaves of the peduncles reduced to small (2–3 mm.) subulate more or less appressed bracts: peduncles 5–22 cm. long, slender, with few usually whorled or scattered bracts: strobiles (1–5 cm. long × 2–2.5 mm.) with sporophylls (2 × 3 mm.), these triangular or somewhat contracted above the base, margin entire or erose: *sporangia* subglobose.

Habitat: In wet places, swamps.

A plant with a very pronounced dorsiventral character, in which the apparently large lateral leaves are really leaves of the under side, giving it a superficial resemblance to a liverwort. Although similar in some regards to *L. inundatum* and *L. pinnatum*, it is to be separated from them by its above just described dorsiventral character.

Specimens from the United States have been examined as follows:

NEW JERSEY: Atsion, Aug., 1897, J. A. Allen (G); Leed's Point, 1833, A. Gray (G); Quaker Bridge (N); Toms River, 1894, L. H. Lighthipe (?); Egg Harbor, Sept., 1884, L. M. Underwood (U); Hospitality Bridge, Aug., 1883, C. A. Gross (strobile 1.5 cm. long) (Y); Toms River, July, 1898, W. N. Clute (Y).

NORTH CAROLINA: Wilmington (G).

SOUTH CAROLINA: Aiken, Ravenel (N).

GEORGIA: Sumter Co., June, 1897, R. M. Harper (Y).

MISSISSIPPI: Ocean Springs, 1896, C. L. Pollard (N).

FLORIDA: Apalachicola, July, 1891; Chap. Herb. (G); Appalachicola, 1856, Chapman (strobile 14 cm. long) (C); Jacksonville, A. H. Curtis, 1896 (G); Eustis, G. V. Nash, July, 1894, no. 1451 (G, C); Lake Worth, Mar., 1891, L. M. Underwood (U); Orange Co., July, 1894, S. L. Lewton (Y); T. W. Webster (strobile 14 cm. long) (Y).

The species also extends through the tropics to Brazil.

9. L. ANNOTINUM L. Sp. Pl. 1103. 1753

Prostrate stems a meter or more long, extensively creeping along the surface, very rarely pinnately branching, stiff, rooting, leafy, with frequent aerial branches 15–25 cm. tall, which fork 1–3 times or not at all, producing slender erect branches, which are usually strobile-bearing: leaves 5–8.5 mm. × 1–1.5 mm., in 8 rows, uniform in shape throughout the plant, longest in the aerial parts where they spread horizontally or are finally somewhat reflexed with upwardly curving apices, lanceolate to linear-lanceolate, broadest at or above the middle, serrulate, acute or pungent: strobiles sessile upon the leafy vertical branches, thick (4 mm. × 1–3 cm.), with broadly ovate sporophylls, the latter with erose margins and subulate tips.

The so-called var. *pungens* with stiffer, shorter more erect leaves is a condition not at all confined to mountain forms.

Distribution: Alaska, Washington, Idaho, Montana, Lake Winnepeg, Colorado, Minnesota, Michigan, Pennsylvania, New York, Massachusetts, Vermont, New Hampshire, Maine, Newfoundland, Greenland.

10. L. CLAVATUM L. Sp. Pl. 1100. 1753

Prostrate stems 1–4 meters long, creeping extensively along the surface of the ground, very leafy, sparingly rooting, branching horizontally, with frequent aerial stems which are immediately ascending or at first prostrate, then ascending, producing pinnate branches of the second and third order, lax, some of them producing stout peduncles, 7–12 cm. long, with subulate, bristle-tipped whorled or scattered bracts and producing one, or frequently 3–4 strobiles: leaves linear or somewhat expanded at the mid-

dle, acute, denticulate, bristle-tipped, entire or minutely denticulate, those of the horizontal stems strongly denticulate: strobiles with deltoid sporophylls, erose, subulate tipped: sporangia reniform.

A widespread species or complex of species extending according to Baker's treatment* throughout the arctic and alpine zones of both hemispheres and in the mountains of tropical Asia, Africa and Polynesia. He reduces nine species under this name several of which will be found to be distinct. Some of the specimens from the Northwest and Alaska are very unlike the eastern forms and usually have much more forked strobiles and are commonly devoid of bristle tips to the leaves. In some particulars they resemble the east Asiatic and Siberian forms with larger suites of which they should be compared than are available in this country. Meanwhile careful field notes of the forms occurring from Oregon northward to Alaska are desirable.

Distribution: Labrador, Newfoundland, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, Quebec, Ontario, Michigan, Wisconsin, Minnesota, Saskatchewan, Oregon, Washington, Alaska.

A large proportion of the material from the Northwest which has been examined differs materially from the eastern plant, the most striking feature being the absence of the bristle tip to the leaf. Plants from Alaska show a dwarfed condition, with shorter peduncles. The distribution of the plant in the Northwest is of interest and is shown here in more detail:

WASHINGTON: In damp woods, 4000–5000 ft. alt., Skamania Co., Aug. 28, 1890, W. N. Suksdorf, no. 1030 (C, G, N); 1889, G. R. Vasey, no. 32 (N, G); deep woods, Pierce Co., Aug., 1895, C. V. Piper (G); forest, Mt. Rainier Range, U. S. South Pac. Exp. Exped., 1838–42, Klickitat Pass, F. E. Lloyd (Y).

OREGON: Base of Mt. Hood, Nov., 1870, G. Howell (G); Bridal Vail, Aug., 1897, J. E. Kirkwood (Y).

BRITISH COLUMBIA: Mt. Benson, N. I., July 10, 1893, J. Macoun (N); 1859, Lyall, no. 1318 (C).

ALASKA: 1879, C. M. Turner (N) and 1881 (G); Kadiak Is., June 27, 1896, B. J. Bretherton (N).

The Mexican and Central American representatives of this spe-

* Handbook of Fern Allies, p. 26.

cies differ in having stems which merge into the peduncles as shown by the gradual reduction of the leaves from the typical foliar condition to that of small bracts, or, again, the peduncles may be entirely leafy. This is probably due to the influence of less abrupt seasonal changes. The forkings of the peduncles are sometimes more distant, and the whole plant has a more lax habit. Specimens have been examined from the following localities:

JAMAICA: Blue Mt. Peak, Dec. 14, 1890, A. S. Hitchcock (U); 1885 (N).

MEXICO: Orizaba, 1853 (C), Jalapa; Vera Cruz, 4000–5000 feet, Dec., 1894, C. L. Smith, no. 2119 (N); Orizaba, 1855 Müller, no. 362 (C); Manzanilla, Mt. Chiapa, 2000 meters, Aug., 1890, J. N. Rovirosa (C).

GUATEMALA: San Miguel Uspantán, Quiche, 7000 feet, April, 1892, Heyde and Lux (C, N).

NICARAGUA: 1853–6, C. Wright (N).

11. L. OBSCURUM L. Sp. Pl. 1102. 1753

L. dendroideum Michx. Fl. Bor. Am. **2**: 282. 1803.

Horizontal stems extensively creeping undergound, giving off single vertical stems which by repeatedly branching produce a bushy mass of foliage 12–25 cm. high: leaves spreading and upwardly curving, linear-lanceolate and twisted, especially above so as to lie in a vertical plane, acute, mucronate, on the lower branches in 8 rows, on the terminal in 6 rows; strobiles sessile: sporophylls broadly ovate, papery and erose-margined, acuminate with a subulate apex: sporangia reniform.

The form with a tendency to dorsiventrality in the terminal branches the upper and lower rows of leaves being shortened and appressed, is supposed to be the one to which the Linnaean name was originally given. It is unfortunate that Michaux's appropriate name could not hold for this miniature tree-like species.

Distribution: Newfoundland, Maine, Quebec, Ontario, New Hampshire, Vermont, Massachusetts, Connecticut, New York, New Jersey, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, Kentucky, Tennessee, Ohio, Minnesota, Michigan, Montana, Alaska.

12. L. CERNUUM L. Sp. Pl. 1103. 1753

Stems 20–35 cm. long, procumbent or arching, with clustered roots at points of contact with the ground, branching often in

different planes, the terminal branchlets often strobile-bearing and nodding: leaves 3–5 mm. long, cylindric, slender, subulate, spreading and upwardly curving: strobiles sessile, 5 mm. long, with small sporophylls (1.5 mm. × 8 mm.) ovate-acuminate, thin with deeply fringed margins: sporangia minute, spherical, transversely compressed.

The plant of the Gulf region seems to differ in no respect from the more tropical form except in size, in the less pronounced upright habit, and in the length of the strobiles.

Specimens from the United States have been examined as follows:

MISSISSIPPI: Ocean Springs, July, 1889, F. S. Earle (U).

ALABAMA: "Springy clay banks," Mobile Co., June, 1889, C. Mohr (U, G, N); Spring Hill, "common in swamp," Aug., 1897, B. F. Bush (Y).

FLORIDA: Lake City, Dec., 1894, F. C. Straub, no. 42 (G); Prairie Creek, A. P. Garber (C, G, N); "moist pine barrens," near Jacksonville, Mrs. A. Curtiss (G); E. Fla., Chapman (G); Waldo, Jan., 1871, Chapman (C); Oneco, Dec., 1897, E. W. Reasoner (U).

Widely distributed through the tropics.

13. L. SITCHENSE Ruprecht. Beitr. z. Pflanzenk. d. Russ. Reich. **3**: 30. 1845

Prostrate stems, 20–30 cm. long, creeping along the surface of the ground or a little buried, occasionally branching and rooting with scale-like leaves, sending up frequent aerial stems which branch dichotomously several (4–6) times to form compact masses of vertical terete branches, 5–7 cm. high, with occasional stronger strobile-bearing branches usually projecting above the tuft: leaves 2 mm. × 5 mm., lanceolate with a broad base, spreading and curving upward, thick, entire, acute, excurrent, in five rows on the branchlets; peduncles short (less than 1 cm.), very slender, with a few minute subulate bracts, or none, the strobiles then being sessile upon strong leafy branches: strobiles (0.8 × 2.5 cm.) with broadly ovate sporophylls with erose margins and long acuminate to subulate apices nearly equaling the sporophyll.

This form has been confused with *L. sabinaefolium* Willd. and Herr Ernst Pritzel, who has kindly examined Wildenow's type sheet for us at Berlin, and has sent some fragments of the sterile branches from the two specimens it contains, assures us that both this plant and what we here regard as true *L. sabinaefolium* are a

part of Willdenow's original material from which he doubtless drew the description of *L. sabinaefolium*. The description of the latter with its expression "foliis lanceolatis acutis quadrifariis" indicates clearly the form Willdenow had in mind in naming the plant.

The plants of the Northeast are usually somewhat more slender and delicate in habit, with short (2–5 mm.) peduncles. The strobiles are sessile upon stronger leafy branches in the Northwestern forms; these leafy branches may readily be mistaken for peduncles.

Specimens have been examined as follows:

ALASKA: Back Bay, July 28, 1895, M. W. Gorman (N); Yes Bay, Aug. 21, 1895, T. Howell, no. 1730 (N), 1732 (Y).

BRITISH COLUMBIA: 49° N. Lat. Ore. Bound. Sur., Dr. Lyall, 1859. (G, lower specimen only.)

WASHINGTON: Mt. Rainier, 5000 ft., Aug., 1895, C. V. Piper (N, G); Lilly Lake, Chehalis Co., 2500 ft., Aug., 1897, F. H. Lamb, 1396 (Y); Olympic Mts., 5500 ft., C. V. Piper (G); Mt. Rainier, 1890, E. C. Smith (G); Mt. Adams, 7000 ft., Aug., 1885, W. N. Suksdorf (N); Stevens Pass, 1200 m., Aug., 1893, Sandberg & Leiberg (N U).

IDAHO: Lower Clark Fork, Oct. 7, 1895, 1820 meters, J. B. Leiberg (N).

ONTARIO: Magpie River, N. of Lake Superior, Aug., 1885, J. Macoun.

NEW YORK: Adirondack Mts., C. H. Peck (U).

MAINE: Mt. Ktaadn, Aug., 1892, S. O. Briggs (G); St. Francis, dry knoll in pasture, Aug. 7, 1893, M. L. Fernald, no. 215. (G, a good specimen with three strobiles.) (N, a smaller sterile specimen.) (U, one strobile.) Fort Kent, dry hillside pastures, June 15, 1898, M. L. Fernald (G).

LABRADOR: Square Island, Lat. 52° 44′ N., Aug. 1882, J. A. Allen (C); St. Michaels, 1891, A. C. Waghorne (N, C).

14. L. SABINAEFOLIUM Willd. Sp. Pl. **5**: 20. 1810

Prostrate stems creeping along the surface, occasionally branching and rooting, with numerous aerial stems which soon branch 3–4 or 5 times to form a loose clump of erect or straggling dorsiventral branches: leaves 1.5–2 mm. long, subulate, slightly

spreading, curved upwards, with thin apices, in four rows on the flattened terminal and subterminal branchlets, those of the lateral rows thicker and more curved than those of the upper and lower rows: peduncles (1–5 cm. long, 1 mm. thick) produced from stronger terete branches with their subulate bracts whorled or scattered: strobiles 2–3 cm. long, with broadly ovate sporophylls with short acute apices: sporangia reniform.

Specimens have been examined as follows:

MAINE: Fort Kent, "in shade," June 15, 1898, M. L. Fernald (G); Dover, "dry woods," Sept. 11, 1894, M. L. Fernald (G).

ONTARIO: Peninsular Harbor, "barren, open prairie," Sept. 16, 1896, G. S. Miller, Jr. (G).

PRINCE EDWARD ISLAND: Brackley Point, Aug., 1888, J. Macoun (U); Stanhope Road, Sept. 5, 1888, J. Macoun (C).

VERMONT: Rochester, "cold, mountain woods," Oct., 1892 (U, G); "cold, evergreen woods," Sept. 23, 1894, W. W. Eggleston (G, C).

15. L. CHAMAECYPARISSUS A. Br.; Doell. Rhein Fl. 36. 1843

16. L. COMPLANATUM L. Sp. Pl. 1104. 1753

These two species have been recently discussed and illustrated. *Cf.* Bull. Torr. Club, **26**: 559–567, *pl. 370*, 15. N. 1899.

The northwestern forms of *L. complanatum* lack the regular compact fan-like habit of the eastern plant, but spread loosely and irregularly and are apparently glaucous. The strobiles are often solitary and in the dwarfed arctic forms of Alaska are very small upon much reduced peduncles. There are, however, at present only insufficient reasons for giving distinct specific rank to these plants. *L. complanatum*, as it grows in Scandinavia, seems to parallel the northwestern condition of the American plant.

Material has been examined as follows:

LAKE SUPERIOR: (No. 22407).

MONTANA: Upper Flathead River, July, 1883, Canby no. 399 (G); MacDonald Lake, Aug., 1892, R. S. Williams (N).

IDAHO: Lake Pend d'Oreille, Sandberg, MacDougal and Heller, July, 1892 (Y, N); Heller, 770 (G).

WASHINGTON: Stampede Pass, Henderson, June, 1892 (G).

NORTHWEST TERRITORY: Red Deer River, 53° N. Lat., July,

1881, J. Macoun (G); Head of Yukon River, June, 1883, Schwatka (G).

ALASKA: Lake Lindeman, May, 1898, R. S. Williams. A very much stunted plant 5 cm. high with strobile 1 cm. long. Specimens identical with these have been collected by Wm. Palmer in Labrador, Aug., 1887 (N).

The Mexican and Central American forms are much taller, more lax, spreading, with more irregular habit. They have been variously referred to *L. complanatum* and *L. thyoides* H. & B. (originally described from Venezuela). Without a larger array of material we hesitate to separate these plants from *L. complanatum*.

17. L. ALPINUM L. Sp. Pl. 1104. 1753

Prostrate stems (20–50 cm. long), creeping at or near the surface of the ground; aerial stems numerous and branching several times to form dense clumps (4–8 cm. high) of markedly dorsiventral branches with glaucous foliage; occasional strobile-bearing branches (the so-called peduncles) thicker, terete and usually projecting above the general mass: leaves of the strobile-bearing branches subulate, those of the purely vegetative branches trimorphic, those of the upper row narrowly ovate, acute, those of the lateral rows thick, with one nerve asymmetrically placed, laterally truncate, acute, falcate, curved toward the under side, those of the under row trowel-shaped: strobiles sessile (1–2 cm. long), with ovate acute sporophylls: sporangia reniform.

This plant varies not a little in the amount of spreading of the lateral leaves, although the characters otherwise are very constant. It is the most highly specialized plant of the whole genus.

Specimens have been examined as follows:

ALASKA: Disenchantment Bay, Aug., 1892, F. Funston (N); July, 1879, L. M. Turner (N); Bischoff (N); Yakutat Bay, Aug., 1892, 1175 M. F. Funston (G, C); Juneau, Aug., 1891, 3000 feet. Grace E. Cooley (C); Unalaska, July, 1872, M. W. Harrington (N, C, G), Oct., 1871 (G), Dr. Mertens (G).

BRITISH COLUMBIA: Cascade Mts., Ore. Bound. Comm., Dr. Lyall, 1859 (G upper specimen only), Griffin Lake, Aug., 1889, J. Macoun (U).

GREENLAND: Sakkertappen, July, 1886 (G); Frederickshaad, Aug., 1886; Kolderup-Rosenvinge (G).

Additional species from tropical North America are represented in American collections examined as follows:

18. L. REFLEXUM Lam. Encyc. Meth. Bot. **3**: 653. 1789

MEXICO, *Vera Cruz:* Müller, 363 (C); Ex-Schlechlendal (C).
GUATEMALA: Tuerckheim (N); J. D. Smith, 504 (C, N).
NICARAGUA: Wright, 6 (N).
CUBA: Wright, 953 (C).
JAMAICA: Wilson (C); Ex-Bot. Garden (N).
PUERTO RICO: Sintenis, 6345 (N, Y).
GUADELOUPE: Perrin (C).
This species is a close ally of *L. lucidulum.*

19. [L. RIGIDUM Gmel. Syst. Nat. **8**: 1289. 1796

Reported from mountains of Martinique and Guadeloupe, but not found in American collections.]

20. L. VERTICILLATUM L. fil. Suppl. 448. 1781

L. setaceum Lam. Encyc. Meth. Bot. **3**: 653. 1789.
L. acerosum Sw. Fl. Ind. Occid. **3**: 1575. 1806.

The type was described from Bourbon, but Old World material in our herbaria is insufficient to verify or disprove the above quoted citations.

MEXICO, *Vera Cruz:* Müller, 361 (C); *Oaxaca:* Pringle, 4994 (C, N).
CUBA: Wright, 935 (C, N).
MARTINIQUE: Pere Duss (Y).

21. L. FUNIFORME Chamisso; Spring Monog. **1**: 50. 1842

CUBA: Wright, 943 (C, N).

22. [L. MOLLICOMUM Mart.; Spring Fl. Bras. **1**: 113. 1840

Reported from Guatemala, but not seen in American collections.]

23. L. LINIFOLIUM L. Sp. Pl. 1100. 1753

MEXICO, *Vera Cruz:* Müller (C).
GUATEMALA: J. D. Smith, 959 (C).
CUBA: Wright, 934, 1825 (C, N).
PUERTO RICO: Sintenis, 1541 (N, Y); Eggers, 8654.

24. L. DICHOTOMUM Jacq. Hort. Vind. **3**: 26. *pl. 45.* 1776

MEXICO, *San Luis Potosi:* Pringle, 2976 (C, N, U), (distributed as *L. taxifolium*).

CUBA: Wright, 944 (C, N).

25. L. TAXIFOLIUM Swz. Fl. Ind. Occid. **3**: 1573. 1806

MEXICO, *Vera Cruz:* C. L. Smith; 2118 (N); Cordoba, Bourgeau (C). *Morelos:* Pringle, 7613.

CUBA: Wright, 937 (C, N).

JAMAICA: Caswell Grave, 3206; Ex Bot. Garden (N).

PUERTO RICO: Sintenis, 1538 (N, Y).

SANTO DOMINGO: Pere Duss (Y).

GRENADA: Sherring, 36 (C).

26. L. AQUALUPIANUM Spring, Monog. **1**: 68. 1842

CUBA: Wright, 936 (C).

PUERTO RICO: Sintenis, 5432 (N, Y).

TRINIDAD: Fendler, 107 (N).

27. [L. SUBULATUM Desv. Encyc. Bot. Suppl. **3**: 544. 1813

Reported from "all tropical America" but not seen in American collections.]

28. L. JUSSIAEI Desv. Encyc. Bot. Suppl. **3**: 543. 1813

JAMAICA: Purdie (C); Ex Herb. Bot. Gard. (N).

29. **Lycopodium Fawcettii** sp. nov.

Horizontal stems trailing giving off at intervals of 2–3 cm. lax clusters of much branched aerial stems (12–15 cm. high) of two sorts, vegetative and peduncular; the vegetative branches flattened, the ultimate divisions elongate slender and rigid (1.5 mm. wide) with four rows of appressed leaves, those of the under row reduced to a triangular tip; peduncular stems arising from near the ground, branching about six times, thick, terete, the ultimate branches the thinnest with 6–8 rows of triangular, thin, membranous tipped leaves; many of the peduncular stems produce ultimately sessile strobiles 2–3 cm. long which scarcely exceed the negative branches, sporophylls broader than long, very abruptly contracted into a subulate tip, sporangia reniform.

JAMAICA: ex herb. Botanical Garden, 1885 (N) (U. S. Nat. Herb 22368=type); Wilson, 1863 (C), a form with abnormal peduncular stems.

SANTO DOMINGO: Wright, Parry, and Brummel, no. 37, 1871 (N, C). Apparently a much more elongate and slender form; Eggers, no. 2270 (C), similar to Wilson's Jamaica form noted above.

This plant is related to *L. complanatum* but is entirely distinct from that species.

Explanation of Plates

PLATE 2

All the figures are drawn to the same scale.

FIG. 1. *Lycopodium sabinaefolium.* A portion of a branch, showing the spreading and incurved lateral leaves.

FIG. 2. The same, lateral view. The leaves of the upper and lower rows are seen to be equally developed and spreading.

FIG. 3. *L. alpinum.* Under side of a part of a branch.

FIG. 4. Lateral view of the same

FIG. 5. *L. Sitchense.* A portion of a branch. Leaves in five rows.

FIG. 6. *L. porophilum.* Sporophyll with sporangium.

FIG. 7. " Leaf.

FIG. 8. *L. Selago.* Leaf.

FIG. 9. " Leaf.

FIG. 10. " Sporophyll.

FIG. 11. *L. lucidulum.* Sporophyll.

FIG. 12. " "

FIG. 13. " Leaf.

PLATE 3

FIG. 14. *L. adpressum.* Transverse section of stem through hibernating region.

FIG. 15. " Transverse section of stem.

FIG. 16. " Leaf.

FIG. 17. " Leaf from peduncle.

FIG. 18. " Sporophyll.

FIG. 19. *L. alopecuroides.* Transverse section of stem.

FIG. 20. " Transverse section of stem through hibernating region.

FIG. 21. " Leaf.

FIG. 22. " Sporophyll.

FIG. 23. *L. inundatum.* Leaf.

FIG. 24. " Leaf.

FIG. 25. " Sporophyll.

FIG. 26. " Transverse section of stem.

FIG. 27. *L. pinnatum.* Transverse section of stem.

FIG. 28. " Leaf.

FIG. 29. " Sporophyll.

FIG. 30. " Leaf.

PLATE 4

L. pinnatum and *L. alopecuroides* from the Chapman Herbarium (C); the former representing Chapman's type specimen.

Studies on the Rocky Mountain Flora.—I*

By P. A. Rydberg

(With Plates 5 and 6.)

SPECIES OF SENECIO OF THE LOBATUS, AUREUS, SUBNUDUS AND TOMENTOSUS GROUPS

It may seem strange that I present here a paper on Senecio, when it is well known to me that Mr. Greenman is occupied in preparing a monograph of the genus in all North America, from the arctic regions to the Isthmus. My work was begun a year ago, and before I knew of Mr. Greenman's work. I have not been able to present my results in print before now, and I do it with the good will of the gentleman mentioned, and with the understanding that I confine myself to the Rocky Mountain region.

The four groups treated here are closely related and grade into each other. They might have been treated as a single group but even this would have been more or less artificial and ill-defined, because there are several intergradations with related groups. The more foliose species of the Aurei as *S. platylobus* and *S. Idahoensis* described below connect with the Eremophili; *S. cymbalarioides* with the Alpicolae, and *S. canovirens* with the Cani.

The work presented here is based on my own studies in the field and the specimens found in the herbaria of the New York Botanical Garden, Columbia University and College of Pharmacy, all in New York City.

LOBATI

Annuals or biennials or perennials with a taproot, perfectly glabrous in age or slightly floccose at the bases of the leaves, more or less leafy throughout, 3 dm. or more high: leaves, all except

*The author intends to publish under this title a series of papers on the Botany of the Rocky Mountain Region. The intention is not however to limit these studies to the botany of the mountains proper, but will include also the Great Plains to the eastward. They will comprise the following states and territories: eastern British Columbia, Alberta. Saskatchewan, Assiniboia, Montana, Idaho, Wyoming, Colorado, New Mexico, eastern Utah, and the extreme western portions of the Dakotas, of Nebraska, Kansas, Oklahoma and Texas.

the very first, pinnately divided: heads rather small and minutely calyculate. In habit resembling the AUREI and TOMENTOSI, to which the last two form a transition, but have more divided leaves and a root of less duration.

Leaves thin; root annual or biennial.
- Head about 1 cm. high; terminal segments of the basal leaves 3–5 cm. wide. 1. *S. sanguisorboides.*
- Head 5–8 mm. high; terminal segments of the basal leaves less than 2 cm. wide.
  - Basal leaves with few segments; segments crenate or dentate. 2. *S. Greggii.*
  - Basal leaves with numerous segments; segments lobed or cleft. 3. *S. millelobatus.*

Leaves rather thick; root perennial.
- Bracts thick, much shorter than the disk. 4. *S. multilobatus.*
- Bracts thin, almost equaling the disk. 5. *S. Nelsonii.*

1. **Senecio sanguisorboides** sp. nov.

Tall and simple, perfectly glabrous, annual or maybe biennial: stem terete, about 6 dm. high, leafy: basal leaves thin, 1–2 dm. long, petioled, pinnately divided with 3–5 segments; terminal segments reniform, 3–5 cm. wide, coarsely crenate; lateral segments almost orbicular, crenate: lower stem leaves similar; the upper with 7–11 segments, short-petioled or the uppermost subsessile; the base of the petioles with large round, laciniate auricles; terminal segment ovate, incised-crenate; the lateral ones obovate or broadly cuneate: cyme rather contracted: heads about 1 cm. high; bracts 12–16, linear-lanceolate, acute, about 1 mm. wide, with membranous margins; the calyculate ones very few and minute, lanceolate: rays about 10, 8 mm. long and 3 mm. wide, about 4-nerved: achenes glabrous and angled.

This has been referred to *S. Sanguisorbae* DC.; but a comparison with De Candolle's description shows several discrepancies. According to the description S. *Sanguisorbae* should have only 8–10 bracts and 5 rays, the leaves should be puberulent beneath and the terminal segment orbicular, characters not found in the present species. The latter grows at an altitude of 2500–3000 m. [Plate 5, f. 14.]

NEW MEXICO: Santa Fe Cañon, 1897, *A. A. & E. Gertrude Heller, 3820* (type in the herbarium of the N. Y. Botanical Garden); White Mountains, 1897, *E. O. Wooton, 494.*

2. **Senecio Greggii** sp. nov.

Senecio Tampicanus A. Gray, Pl. Fendl. 109. 1849; not DC., 1837; *S. lobatus* A. Gray, Pl. Wright. 2: 99. 1852; not Pers. 1807.

Biennial or annual, with several stems from the base, perfectly glabrous in age: stems about 3 dm. high: leaves pinnately divided or the very first ones simple: basal leaves with 3–5 segments, the terminal one round and crenate, about 1 cm. in diameter; the lateral ones small, obovate; stem leaves with 7–9 small segments and more or less auricled at the base of the very short petiole: cyme compound: heads rather many, only 5–7 mm. high; bracts about 20, linear-acuminate; the calyculate ones minute and few: rays 8–10, about 3 mm. long and 1.5 mm. wide, 3-nerved: achenes angled and strigose.

This is nearest related to *S. lobatus* but smaller and characterized by the many stems from the same root, the few segments of the basal leaves, the small heads and the narrow bracts. Only Wright's specimens were collected in the region here treated. [Plate 5, f. 8.]

MEXICO: Santa Rosalia, *Dr. Gregg* (type in Torrey Herbarium).

TEXAS: Near El Paso, 1851–2, *C. Wright, 1413;* between Frio and Nueces Rivers, 1880, *E. Palmer, 754;* Loredo to Frontera, *Wright* (Mexican Boundery Survey), *659*, in part.

3. **Senecio millelobatus** sp. nov.

Senecio Tampicanus A. Gray, Pl. Wright. **2**: 99. 1852; not DC. 1837; *S. multilobatus* A. Gray, Syn. Fl. **1**^{2}: 394, in part. 1884; not T. & G. 1849.

Annual or biennial, perfectly glabrous or slightly floccose at the base of the leaves: stem branched, 3–5 dm. high, very leafy: all leaves pinnately divided, 3–7 cm. long, lanceolate or oblanceolate in outline; segments 13–23, obovate, 3–10 mm. long, lobed or cleft into oblong or ovate lobes; the upper segments more or less confluent: cyme compound: heads about 8 mm. high; bracts oblong-lanceolate, acuminate, 12–15 in number; calyculate ones minute and few: rays 5–8 mm. long and 1.5–2 mm. wide: achenes very scabrous on the angles.

This is nearest related to the preceding and to *S. lobatus* but is easily distinguished by the numerous and lobed or cleft segments. It may be related to *S. Tampicanus* which I have not seen, but that species is described as having only 4 or 5 pairs of segments and glabrous achenes. [Plate 5, f. 11.]

NEW MEXICO: Hills on the Limpia, 1851–2, *C. Wright, 1287* (type in the Torrey herbarium); *P. V. Le Roy.*

TEXAS: Lower Rio Grande, 1852, *Parry* (Mexican Boundary Survey), *658*.

4. SENECIO MULTILOBATUS Torr. & Gray; Gray, Pl. Fend. 109. 1849

The type of this species is in the Torrey herbarium and very unlike the plant regarded by Gray as *S. multilobatus*. It is characterized by its fleshy leaves and stands perhaps nearer to *S. compactus* than to the group with which it was associated by Dr. Gray. I have placed it in this group on account of its pinnatifid basal leaves. The earliest of these are, however, entire, in the same manner as they occasionally are in *S. rosulatus*. This analogy and the close relationship to *S. compactus* undoubtedly made Prof. Greene name Baker, Earle and Tracy's specimens "*Senecio compactus* Rydb., verging towards *S. Fendleri*." These specimens differ from Fremont's plant only in the fact that the basal leaves are shorter and less divided. Eastwood's specimens are exactly like the type. The base of these specimens shows that the plant is a perennial rather than an annual as stated in the original description. It grows at an altitude of about 2000 m. [Plate 6, f. 11.]

UTAH: Uintah River (a tributary of Greene River), *Fremont, 549* (type in the Torrey herbarium); Ogden, 1871, *Hayden Survey*; South Utah, *J. E. Johnson*.

COLORADO: Grand Junction, 1892, *A. Eastwood*; Mancos, 1898, *Baker, Earle & Tracy, 446*; Dolores, 1892, *C. S. Crandall*; South Park, 1871, *W. M. Canby*.

5. SENECIO NELSONII Rydb. Bull. Torr. Club, **24**: 483. 1899

Prof. Greene in Pittonia, **4**: 112, devotes over a page to this species, claiming it to be the same as *S. Fendleri*, and criticises both Prof. Nelson and myself. We had, however, both investigated the matter thoroughly before the species was published. In claiming that the two species are the same, Prof. Greene must either not know one of the plants or both, or else do it for the purposes of finding fault. *S. Nelsonii* has the leaf form of *S. Fendleri*, but there ends the similarity. In the former the caudex is short, not woody, and with numerous fibrous roots, placing it nearer to *S. multilobatus* and *S. compactus*, while *S. Fendleri* has a very thick

and woody rootstock. The heads of *S. Nelsonii* are larger, 8–10 mm. high, and the bracts are thin and in anthesis almost equal the disk, while in *S. Fendleri* they are thick and much shorter. The former also lacks the fine tomentum of the latter; it is merely floccose when young in the manner of *S. multilobatus* and *S. compactus*. *S. Nelsonii* is dark green while *S. Fendleri* is more or less yellowish. Neither of the species forms mats, as Prof. Greene states. Heller's specimens, from the type locality of *S. Fendleri*, agree fully with Gray's description of that species, except that they are more glabrate than the type. They represent a plant of several season's growth, but show nothing to indicate a matted plant. I think that Prof. Greene has here confused *S. rosulatus* with the two. Prof. Greene's conception of *S. Fendleri* must be very comprehensive, indeed, as he also includes in that such forms as *S. subcuneatus*, *S. canovirens*, and another species, nearly related to *S. fastigiatus* Nutt. This statement is founded on specimens determined by Prof. Greene only a year or two ago and found in the herbarium of the New York Botanical Garden. By comparing Plate 5, Fig. 6, and Plate 6, Figs. 1, 3, 4 and 9, with each other, one can get an idea of Prof. Greene's conception of *S. Fendleri*.

I have seen no specimens of *S. Nelsonii* except the type.

AUREI

Slender perennials, over 2 dm. high, with a short erect caudex or rootstalk, glabrous or slightly floccose when young, the wool remaining in age only at the base of the leaves: basal leaves entire, merely toothed: stem leaves more or less pinnatifid and the upper more or less reduced: heads small, cymose, with very small and few calyculate bracts.

Heads radiate.
- Leaves thick, more or less fleshy.
  - Basal leaves narrowly oblanceolate.
    - Plant low, less than 2 dm. high, often with several stems from the base; basal leaves short-petioled.
      - Cyme dense; upper leaves generally pinnatifid with narrow lobes. 6. *S. compactus.*
      - Cyme more open; stem leaves entire or merely crenate.
        - Basal leaves subentire or 3-toothed at the apex. 7. *S. tridenticulatus.*
        - Basal leaves crenate. 8. *S. oblanceolatus.*

Plant about 4–6 dm. high, simple.
Leaves serrate or subentire; basal leaves 1 cm. or more, slender-petioled. 9. *S. longipetiolatus.*
Stem leaves with long, triangular lobes; basal leaves 5 cm. or less. 10. *S. fulgens.*
Basal leaves cuneate, spatulate or broadly oblanceolate, subentire at the base.
Lower stem leaves spatulate with a broad-winged petiole; upper ones sessile and with much enlarged bases. 11. *S. crocatus.*
Stem leaves neither broad-winged nor with much enlarged bases.
Basal leaves crenate above the middle. 12. *S. cymbalarioides.*
Basal leaves angularly dentate. 13. *S. Jonesii.*
Basal leaves sharply dentate or serrate above the middle.
Lower stem leaves cuneate, plant 3–4 dm. high. 14. *S. subcuneatus.*
Lower stem leaves oblanceolate; plant about 2 dm. high. 15. *S. acutidens.*
Leaves thin.
Basal leaves ovate or more commonly cordate, serrate. 16. *S. pseudaureus.*
Basal leaves obovate or oval, crenate or sinuate-dentate.
Stem leaves ovate in outline, with broad segments. 17. *S. platylobus.*
Stem leaves lanceolate or oblanceolate in outline, with narrow segments. 18. *S. flavovirens.*
Stem leaves spatulate or oblanceolate in outline, with short and broad segments. 19. *S. aurellus.*
Head discoid.
First basal leaves reniform. 20. *S. nephrophyllus.*
None of the leaves reniform.
Plant stout; stem leaves with broad laciniate segments. 21. *S. Idahoensis.*
Plant slender; stem leaves with narrow segments.
Plant yellowish or light green; bracts not purple-tinged. 17. *S. flavovirens.*
Plant dark green.
Basal leaves crenate; head 8–10 mm. high; bracts purple-tinged, linear. 22. *S. pauciflorus.*
Basal leaves wavy; heads about 6 mm. high; bracts broadly lanceolate or oblong, not purple-tinged. 23. *S. fedifolius.*

6. SENECIO COMPACTUS (A. Gray) Rydb. Mem. Torr. Club, **5**: 342. 1893

Senecio aureus var. *compactus* A. Gray, Syn. Fl. **1**[2]: 391. 1884.

Dr. Gray's description covers two if not three species. For which of these *S. compatus* should be used is a matter of question. I have adopted it for the plant of the plains with a dense cyme and usually pinnatifid-dentate stem leaves. Dr. Gray evidently had this plant in mind when he adopted the name *com-*

pactus. The description seems to indicate mostly this species, which also I had in mind when I raised the variety to specific rank and it is this that is described and figured in Britton and Brown's Illustrated Flora. On the other hand if synonomy and the citation of specimens are taken in consideration, the name may have been applied to the next, for the first synonym and the first specimen cited belong to that species. [Plate 5, f. 15.]

NEBRASKA: Valentine, *J. M. Bates, 34;* Lewellen, *G. D. Swezey, 82;* Fort Niobrara, 1888, *T. E. Wilcox;* Thedford, 1893, *P. A. Rydberg, 1311;* Platte Bottom, 1891, *211.*

COLORADO: Plains, 1882, *Allen & Brewster;* Colorado Springs, 1892, *Isabel Mulford.*

7. **Senecio tridenticulatus** sp. nov.

Senecio aureus var. *borealis* A. Gray, Pl. Wright. 1: 125. 1852; not T. & G. 1843; *S. aureus* var. *compactus* A. Gray, Syn. Fl. 1^2: 391; in part.

Perennial with a branched caudex, in age perfectly glabrous, or slightly floccose at the base of the leaves: stems very slender, about 3 dm. high: basal leaves very narrowly oblanceolate, thick with a slender petiole, slightly 3-toothed at the apex or wholly entire, 4–8 cm. long and 4–5 mm. wide: stem leaves linear and subentire: cyme open and corymbiform: heads 7–8 mm. high: bracts lanceolate, acute ⅔ or ¾ as long as the disk: rays light yellow, about 8 mm. long and 1–1.5 mm. wide, 3-nerved; achenes hispid-puberulent on the angles.

This species differs, from the preceding in the slender stem and the open cyme, and also in the form of the leaves. The latter character also separates it from the next following. It grows in wet sandy soil. The type was growing at an altitude of 2400 m. Wright's specimens are past blooming, and good characters could not be taken from them, wherefore I have made Sheldon's specimens the type. The latter were mixed with some of the next. [Plate 5, f. 12.]

COLORADO: Cottonwood Creek, Buena Vista, 1892, *C. S. Sheldon* (type in the herbarium of N. Y. Botanical Garden).

TEXAS: Mountains beyond the Limpia, 1849, *Wright, 403.*

8. **Senecio oblanceolatus** sp. nov.

Perennial with several stems from a strong root, in age glabrous or rarely slightly floccose at the base of the leaves: stems short and

stout, about 2 dm. high: basal leaves oblanceolate, thick and fleshy, 4–6 cm. long, obtuse, crenate with entire long tapering bases or the first subentire: stem leaves similar or reduced and linear in outline: cyme corymbiform, not compact: heads about 8 mm. high; bracts linear acute, yellowish green; the calyculate ones minute and few: rays 5–6 mm. long and about 1.5 mm. wide, 4-nerved: achenes minutely scabrous on the angles.

This species has also been included in *S. aureus compactus*, but lacks the dense inflorescence of *S. compactus* as here understood. The stem leaves never show any indication of being pinnatifid with narrow lobes as in that species. *S. compactus* is a plant of the Great Plains, while *S. oblanceolatus* is a mountain plant growing at an altitude of 1800–3000 m. [Plate 5, f. 9.]

COLORADO: Como, South Park, 1895, *C. S. Crandall* (type in the herbarium of N. Y. Botanical Garden); El Paso County, 1897, *A. A. & E. Gertrude Heller, 3508;* Cottonwood Creek, Buena Vista, 1892, *C. S. Sheldon.*

9. **Senecio longipetiolatus** sp. nov.

A tall, simple, perfectly glabrous perennial, with a short erect rootstock: stem strict, 3–6 dm. high, terete: basal leaves oblanceolate, 1–1.5 dm. long, with a slender petiole, from serrate to subentire: lower stem leaves similar; the upper reduced, lanceolate, sessile, sharply serrate, or laciniate-dentate, often auricled at the base: cyme dense, corymbiform: heads 8–9 mm. high: bracts about 20, linear, acute: the calyculate ones few, minute, subulate and crisp: rays dark orange, 4–7 mm. long and 1.5 mm. wide, 3–4-nerved: achenes strongly angled, glabrous.

In the type the basal leaves are strongly serrate, but in the Colorado plants they are indistinctly so or subentire. Baker, Earle & Tracy's specimens were named by Professor Greene, *Senecio crocatus* Rydb. but it is entirely distinct from anything collected by Hall & Harbour, and has nothing that fits any description of *S. aureus* var. *croceus*, except the dark rays. See further remarks under *S. crocatus*. *S. longipetiolatus* grows at an altitude of 2000–3000 m. [Plate 6, f. 10, 10a.]

WYOMING: Spread Creek, Teton Forest Reserve, 1897, *F. Tweedy, 585* (type in the herbarium of N. Y. Botanical Garden).

COLORADO: Medicine Bow Range, 1891, *C. S. Crandall;* Hamor's Lake, north of Durango, 1898, *Baker, Earle & Tracy, 625.*

10. **Senecio fulgens** sp. nov.

Simple and glabrous perennial with a very short caudex: stem about 3 cm. high: basal leaves oblanceolate, thick and somewhat fleshy, with the petiole about 5 cm. long, dentate or subentire: lower stem leaves spatulate with a winged petiole, coarsely dentate; upper stem leaves sessile with an auricled base, lobed with triangular or triangular lanceolate lobes, acute: cyme corymbose and rather dense: heads about 8 mm. high: bracts about 15, oblong, acute, with a broad membranous margin; the calyculate ones few, lanceolate: achene striate, glabrous: rays 4–5 mm. long and 2 mm. wide, dark orange.

Closely related to the preceding, but differing in the short basal leaves and the lobed upper stem leaves and also in the fewer and broader bracts. It grows at an altitude of about 2700 m. [Plate 6, f. 13.]

WYOMING: Grand Creek, Teton Forest Reserve, 1897, *F. Tweedy, 584* (type in the herbarium of N. Y. Botanical Garden).

11. SENECIO CROCATUS Rydb. Bull. Torr. Club, **24**: 299. 1897

Senecio aureus var. *croceus* A. Gray, Proc. Acad. Nat. Sci. Phila. **1863**: 68, 1863; not *S. croceus* DC. 1837.

When the above name was published I did not know that this variety of Gray's was a complex one. Hall & Harbour's no. *332*, which is the type, consists of two different things; but as one of them is rayless it can not be taken as the type of the var. *crocatus*, which was named from its orange rays. That I did not draw a new diagnosis, I admit, was perhaps careless, but this blunder I think was not worth a page and a half of discussion as it was given by Professor Greene in Pittonia, **4**: 114–116. I committed just the same mistake as Professor Greene himself in establishing *Antennaria media* Greene, Pittonia, **3**: 286. What Professor Greene says of Mr. E. Nelson in Pittonia, **4**: 85 can be applied to himself. Gray's description of the var. *croceus* in the Proceedings of the Philadelphia Academy is perhaps not adequate, but this description is supplemented in the Synoptical Flora and elsewhere and I think that *Senecio aureus* var. *croceus* Gray is amply published according to all rules we have. If so, *Senecio croceus* Rydberg is not a nomen nudum, whatever Professor Greene may say. Professor Greene in 1897 or 1898 accepted my name, for he named Baker, Earle &

Tracy, no. 625, *S. crocatus* Rydberg. This mistake is just as unpardonable because that plant shows none of the characters, assigned to *S. aureus* var. *croceus* Gray, except the color of the rays, and this character Professor Greene, agrees with me in regarding as of little value. That Professor Greene and other botanists may know what I now mean by *S. crocatus* I shall give a diagnosis, here following Professors Greene's example in the case of *Antennaria media.*

A glabrous perennial with a short erect rootstock: stem 1.5–3 dm. high: basal leaves 2–3 cm. long, obovate or spatulate, crenate or subentire with a winged petiole: lower stem leaves similar but with broader, winged petioles which are somewhat auricled at the base, or else oblong without distinction between blade and petiole and then more auricled: upper stem leaves ovate or triangular with very large and large-toothed auricles: cyme small and compact with 2–5 mm. heads, which are 8–10 mm. high: bracts about 20, linear: rays 7–8 mm. long and 1.5–2 mm. wide, orange to pale yellow, achenes striate, glabrous. [Plate 5, f. 13.]

COLORADO: Middle Park, 1862, *Hall & Harbour, 332*, in part (type); *329*, in small part; 1868, *Geo. Vasey* (Powell's Expedition), *340 B;* South Cottonwood Gulch, 1892, *C. S. Sheldon;* Gray's Peak, 1872, *John Torrey;* (?) Little Kate Mine, 1898, *Baker, Earle & Tracy, 569;** South Park, 1871, *Canby;* Long's Peak, 1886, *Letterman* (depauperate).

WYOMING: La Plata Mines, 1895, *Aven Nelson, 1769.*

SENECIO DIMORPHOPHYLLUS Greene, Pittonia, **4**: 109. 1900

I have not seen any specimens of this species, and have not been able to include it in the key. It is described as being a foot (about 3 dm.) high, light green and with long golden-yellow rays. Otherwise the description reads much like that given above for *S. crocatus.* The type was collected about Pagosa Peak, Colo., in 1899, by C. F. Baker.

12. SENECIO CYMBALARIOIDES Nutt. Trans. Am. Phil. Soc. II., **7**: 412. 1841

Senecio aureus borealis Torr. & Gray, Fl. **2**: 442. 1843; *S. aureus obovatus* Eat. King's Exp. **5**: 190, in part. 1871.

*These specimens were named *Senecio heterodoxus* Greene n. sp., but I can not find any published description. They differ from the rest in being cespitose, with less marked differentiation in the leaves and with traces of floccose pubescence at the bases of the leaves and heads. The species may be distinct.

This has sometimes orange rays and has then been confused with *S. crocatus*, but it lacks the winged petioles of the lower leaves and the large auricles of the upper. It often reaches a height of 3 dm. and then many of the stem leaves are also spatulate. Such a form with more permanent woolliness is Watson's no. 669; otherwise I cannot distinguish it from *S. cymbalariodes*. [Plate 5, f. 1.]

BRITISH AMERICA: Mackenzie River, 1861–2, *I. S. Onion.*

MONTANA: Park Co., 1887, *Tweedy, 343*, in part; Silver Bow Co., *Mrs. Moore;* Jack Creek, 1897, *Rydberg & Bessey, 5266.*

WYOMING: Beaver Cañon, 1895, *Rydberg;* Bacon Creek, 1894, *Aven Nelson, 906.*

IDAHO: Mt. Chauvet, 1897, *Rydberg & Bessey, 5267.*

UTAH: Wasatch Mts., 1869, *S. Watson, 669.*

WASHINGTON: Mt. Paddo, 1882, *W. N. Suksdorf;* Columbia, *Nuttall* (type).

13. **Senecio Jonesii** sp. nov.

A glabrous perennial: stem about 3 dm. high, slender, terete: basal leaves rounded-obovate, sinuately toothed, sometimes with a pair of small lobes at the base; their petioles often tinged with red: stem leaves oblanceolate in outline, pinnatifid with oblong segments, generally short-petioled: cyme corymbiform: heads about 8 mm. long: bracts 12–15, lanceolate, acuminate, about ⅔ as long as the disk, membranous margined; calyculate ones few, linear: rays about 5 mm. long and 2 mm. wide, 4-nerved: achenes very strongly striate, glabrous.

Nearly related to the preceding, but differing in the toothing of the leaves and the form of the bracts. The type was collected at an altitude of 3300 m. [Plate 6, f. 5.]

UTAH: Alta, Wasatch Mountains, 1879, *M. E. Jones, 1125* (type in the Columbia Herbarium).

14. **Senecio subcuneatus** sp. nov.

Perennial with a branched caudex, slightly floccose when young, glabrate in age: stems 3–4 dm. high: basal leaves about 5 cm. long, spatulate or cuneate, dentate or serrate above the middle, entire at the base and tapering into a short petiole, rather thick: lower stemleaves narrowly cuneate, short-petioled, dentate at the apex: upper ones linear and sessile, often sharply dentate: cyme corymbiform: heads about 8 mm. high: bracts about 15,

lanceolate, acute, shorter than the disk: rays 4–5 mm. long and 1.5 wide, 4-nerved: achenes striate, glabrous.

This species is nearest related to *S. cymbalarioides* but is taller, with narrower basal leaves, which have sharper teeth; the heads are also much more numerous. It grows at an altitude of 2000–2500 m. Baker, Earle and Tracy's specimens were labeled by Prof. Greene *Senecio Fendleri*, approaching *S. compactus*. This is strange from one that claims that he has known *S. Fendleri* since 1870.* This plant has little in common with that species or with *S. Nelsonii* Rydb. [Plate 5, f. 6.]

COLORADO: Grizzly Creek, 1896, *C. F. Baker* (type in the herbarium of N. Y. Botanical Garden); Lake City, 1878, *H. W. Pease* (depauperate); Mancos, 1898, *Baker, Earle & Tracy, 63*.

15. **Senecio acutidens** sp. nov.

Perennial, with a thick woody rootstock and short caudex, in age glabrate or slightly floccose at the base of the leaves: stems several, about 2 dm. high, angled, more or less tinged with red: basal leaves about 5 cm. long, thick, fleshy and somewhat glaucous, obovate or spatulate: sharply dentate above the middle, at the base entire and abruptly contracted into a slender petiole: lower stem leaves similar or oblanceolate and acute; the upper reduced, linear, laciniate-dentate or somewhat pinnatifid: cymes corymbiform and rather dense: heads 8–10 mm. high: bracts broadly linear, acute, ⅔ or ¾ as long as the disk: rays about 5 mm. long and 1.5 mm. wide, 3–4-nerved: achenes slightly angled, glabrous.

Nearest related to *S. cymbalarioides* but the leaves are thicker, more glaucous and very acutely dentate. The perennial rootstock and caudex are also thicker and more woody. [Plate 5, f. 2.]

WYOMING: Union Pass, 1894, *Aven Nelson, 858* (type in the herbarium of N. Y. Botanical Garden).

16. SENECIO PSEUDAUREUS Rydberg, Bull. Torr. Club, **24**: 298. 1897

This is nearest related to the eastern *S. aureus* and has the same subcordate, thin, basal leaves, but these are distinctly serrate, instead of crenate. It is the most common species of the group in the Rockies, growing in wet meadows at an altitude of 1000–3000 m. [Plate 5, f. 10.]

* See Pittonia, **4**: 112.

MONTANA: Little Belt Mountains, 1896, *Flodman, 918* (type); Madison Co., *Mrs. McNulty;* Bear Gulch, 1887, *F. Tweedy, 340;* Columbia Falls, *Mrs. Kennedy, 9;* Spanish Basin, 1897, *Rydberg & Bessey, 5263;* Indian Creek, *5264.*

WYOMING: Lone Star Geyser Basin, Yellowstone Park, 1897, *Rydberg & Bessey, 5262.*

COLORADO: Grizzley Creek, 1896, *C. F. Baker;* Long's Peak, 1886, *G. W. Letterman;* Mancos, 1898, *Baker, Earle & Tracy, 45.*

NEW MEXICO: Pecos River, 8 miles east of Glorietta, 1897, *A. A. & E. Gertrude Heller, 3682.*

UTAH: E. Humbolt Mts., 1868, *S. Watson, 667.*

17. **Senecio platylobus** sp. nov.

S. aureus var. *croceus* D. C. Eaton, King's Exp. **5**: 190, in part. 1871; not Gray. 1863.

A stout, perfectly glabrous perennial: stem about 4 dm. high, rather leafy, striate and somewhat angled: basal leaves 6–10 cm. long, slender-petioled, obovate or broadly oval, sinuately crenate-dentate, thin: lower stem leaves oblanceolate, petioled, deeply lobed or divided with rounded lobes: upper stem leaves broadly ovate in outline, sessile, pinnately divided into broadly oblong or cuneate divisions which are more or less deeply sinuate-dentate: cyme compound; its branches corymbiform: heads about 8 mm. high; bracts broadly lanceolate, acute, membranous margined and slightly shorter than the disk: rays 6–7 mm. long, and 3 mm. wide, 5-nerved: achenes striate, glabrous.

Probably nearest related to the preceding, but easily distinguished by the form of the leaves and the broad rays. It grows at an altitude of about 1500 m. [Plate 6, f. 8.]

UTAH: Wasatch Mountains, 1869, *S. Watson, 671* (type in the Torrey Herbarium).

18. **Senecio flavovirens** sp. nov.

S. Balsamitae Rydberg, Mem. N. Y. Bot. Gard., **1**: 446, mainly; 1900; not Muhl. 1804.

Light or yellowish green, slender, perennial, in age glabrate or slightly floccose at the base of the leaves: stem 3–4 dm. high, striate, pale: basal leaves 3–8 cm. long, obovate or broadly oval, generally tapering into the petioles, but sometimes truncate at the bases, obtuse, crenate or sinuate, light green: lower stem leaves ob-

lanceolate in outline and petioled; the upper lanceolate or linear in outline and sessile; all deeply pinnatifid with narrow, oblong or linear segments: cymes contracted, corymbiform: heads 7–8 mm. high; bracts linear, acute, yellowish-green, and occasionally with brownish tips, a little shorter than the disk; calyculate ones few, linear, small and crisp: rays pale yellow, about 6 mm. long and 1.5 mm. wide, 4-nerved, or very often lacking: achenes hispid-puberulent on the angles.

Nearest related to the eastern *S. Balsamitae*, but characterized by its yellowish green color and a more contracted cyme. It grows at an altitude of 2000–3000 m. [Plate 5, f. 4.]

IDAHO: Beaver Cañon, 1895, *Rydberg* (type in the herbarium of N. Y. Botanical Garden).

MONTANA: Deer Lodge, 1895, *Rydberg, 2850* (rayless); Helena, 1887, *F. D. Kelsey, 501.*

WYOMING: Buffalo Fork, 1897, *Tweedy, 586;* Laramie Plains, 1889, *E. L. Greene* (rayless); Green River, 1894, *Aven Nelson, 1036* (rayless).

19. **Senecio aurellus** sp. nov.

Perennial with a short rootstock, somewhat floccose when young, soon glabrate: stem striate, 4–5 dm. high: basal leaves spatulate or cuneate, dentate-serrate, about 5 cm. long, with a short petiole, soon glabrous: lower stem leaves long-petioled, cuneate or spatulate, lyrately lobed, the upper narrowly oblanceolate and subsessile, slightly auricled at the base: cyme compound but with rather few heads, which are about 8 mm. high: bracts 12–16, glabrous, yellowish-green, lanceolate, thin; calyculate ones minute, lanceolate: rays golden-yellow, 5–6 mm. long and 2 mm. wide, 4-nerved: achenes scabrous hispidulous on the angles.

In the form of the stem leaves this most resembles, perhaps, *S. rosulatus*, but these are thinner and perfectly green, only slightly floccose when young. Otherwise it is intermediate between the eastern *S. Balsamitae* and *S. multilobatus.* The type was determined by Professor Greene as "*S. pseudaureus* Rydb., not typical." To that species it does not have any close relationship. [Plate 6, f. 12, 12a.]

COLORADO: Mancos, 1898, *Baker, Earle & Tracy, 998* (type in the herbarium of New York Botanical Garden).

20. SENECIO NEPHROPHYLLUS Rydberg, Mem. N. Y. Bot. Garden, 1: 446. 1900

Related to the two preceding, but characterized by the rayless heads, the reniform first basal leaves which resemble those of *Oxyria digyna*, and the pinnatifid stem leaves with their oblong blunt segments. The Colorado specimens are much lower than the type, being about 2 dm. high. [Plate 6, f. 15.]

MONTANA: Big Blackfoot River, 1883, *Canby, 203.*

COLORADO: South Park, 1872, *T. C. Porter;* Middle Park, *Hall & Harbour, 332,* in part.

21. **Senecio Idahoensis** sp. nov.

Stout perennial, in age glabrate or slightly floccose at the base of the leaves: stem 4–5 dm. high, branched, striate, tinged with purplish: basal leaves obovate, serrate: lower stem leaves oblanceolate in outline, about 1 dm. long, petioled; the upper ovate or lanceolate in outline, sessile and auricled at the base; all bluish-green, pinnately divided into oblong or oblique-cuneate incised segments: heads numerous, about 1 cm. high; bracts about 25, very narrowly linear, equaling the disk: rays none: achenes striate, glabrous.

A species somewhat related to *S. aureus*, but characterized by its broad and laciniate leaves, rayless heads and numerous very narrow bracts. [Plate 6, f. 5.]

IDAHO: Granite Station, 1892, *Sandberg, McDougal & Heller, 803* (type in the N. Y. Botanical Garden herbarium).

22. SENECIO PAUCIFLORUS Pursh, Fl. Am. Sept. 529. 1814

This species, characterized by its few (2–6) rayless heads, linear purple tinged bracts, equaling the disk in length, and its small rounded-oval crenate basal leaves, has been collected several times in Labrador; but exactly similar specimens are in the Torrey herbarium and were collected by Burke in the Rocky Mountains, but the locality is not given. [Plate 5, f. 3.]

23. **Senecio fedifolius** sp. nov.

A delicate glabrous perennial with a very short caudex and a clump of fibrous roots: stem slender, weak, about 1.5 dm high: basal leaves 3–5 cm. long with a slender petiole; blade 1–2 cm. long, rounded-ovate or broadly oval, wavy or subentire: stem

leaves mostly small, pinnately divided into short oblong segments: heads 2–3, about 6 mm. high, somewhat turbinate; bracts 12–15, broadly lanceolate, conspicuously membraneous margined: rays none: achene glabrous.

The species is named from the resemblance the basal leaves have to those of certain species of *Valerianella* which genus has also been known under the name *Fedia*. [Plate 5, f. 7.]

COLORADO: South Park, 1871, *W. M. Canby* (type in the herbarium of the College of Pharmacy, New York).

SUBNUDI

A slender perennial with a long slender horizontal rootstock, perfectly glabrous, sparingly leafy, monocephalous: basal leaves broadly obovate, coarsely crenate-dentate: heads decidedly turbinate with narrow linear-acuminate bracts; calyculate bracts, if present, few, and half as long as the main series. A single species.

24. SENECIO SUBNUDUS DC. Prod., **7**: 428. 1837

Senecio aureus var. *subnudus* Gray, Syn. Fl. **1**[2]: 391. 1884.

This species has been included as a variety of *S. aureus*, but I think it should be regarded as the type of a distinct group. The long slender horizontal rootstock and the decidedly turbinate involucre is not found in any of the *aureus* allies. The latter characters would place it near *S. frigidus*. [Plate 6, f. 2.]

WASHINGTON: Chiquash Mountains, 1892, *Suksdorf, 2167*; Cascade Mountains, 1882, *Brandegee, 118*.

OREGON: 1882, *T. Howell*; 1871, *Elihu Hall, 304*.

CALIFORNIA: Butterfly Valley, 1874, *Mrs. R. M. Austin*.

MONTANA: Park Co., 1887, *Tweedy, 344*; Pony, 1897, *Rydberg & Bessey, 5270*.

WYOMING: Wind River, 1842, *Fremont*; Buffalo Fork, 1897, *Tweedy, 587*; Yellowstone Park, 1884, *Tweedy, 120*.

TOMENTOSI

Perennials, over 2 dm. high, with a short caudex or rootstock, which often is subligneous and cespitose, floccose when young, becoming more glabrate in age, but with some wool always remaining: basal leaves, except the very first ones, from serrate or dentate to pinnatifid: stem leaves always present, but often reduced, generally pinnatifid or pinnately lobed or toothed: heads cymose, small, with few and very small calyculate bracts.

The group is closely related to the AUREI and LOBATI with which it is connected through *S. Plattensis* and *S. Fendleri* respectively. *S. Nelsonii* and *S. multilobus* in young state may also be sought here.

Basal leaves mostly dentate or crenate.
- Basal leaves suborbicular, ovate or cordate; margins of the petioles arachnoid-tomentose. 25. *S. flavulus.*
- Basal leaves obovate or spatulate.
  - Lower stem leaves acute; plant dark green. 26. *S. Plattensis.*
  - Lower stem leaves obtuse; plant yellowish-green. 27. *S. Neo-Mexicanus.*
- Basal leaves lanceolate or oblanceolate.
  - Basal leaves narrowly oblanceolate, serrate. 28. *S. salicinus.*
  - Basal leaves lanceolate, sinuate-dentate. 29. *S. canovirens.*

Some of the basal leaves entire or dentate, the rest pinnatifid or pinnately lobed.
- Plant conspicuously rosulate-stoloniferous; stem leaves sinuately round-lobed. 30. *S. rosulatus.*
- Plant not stoloniferous; stem leaves pinnatifid with toothed lobes. 26. *S. Plattensis.*

All leaves pinnatifid with toothed segments.
- Caudex subligneous; plant tomentose; bracts shorter than the disk. 31. *S. Fendleri.*
- Caudex not subligneous; plant glabrate.
  - Bracts almost equaling the disk. 5. *S. Nelsonii.*
  - Bracts much shorter than the disk. 4. *S. multilobus.*

25. SENECIO FLAVULUS Greene, Pittonia, **4**: 108. 1900

I have seen no specimens of this species, but from the description it must be most nearly related to the next, differing in the more slender habit, the small leaves and their form and the peculiar arachnoid tomentum on the margins of the petioles. The type was collected by C. F. Baker at Aboles, Colo., in 1899.

26. SENECIO PLATTENSIS Nutt. Trans. Am. Phil. Soc. II. **7**: 413. 1841

This species is exceedingly variable as to the leaf form as well as to the pubescence; usually the basal leaves are merely serrate and obovate or oval in outline, but sometimes some of them are like the lower stem leaves, more or less lyrately pinnatifid. It is conspicuously floccose when young, but in age the leaves become almost glabrous and the wool remaining only on the lower part of the stem and petioles. The species belongs to the region of the plains. [Plate 6, f. 14.]

SOUTH DAKOTA: Brookings, 1897, *L. W. Carter;* Hot Springs, 1892, *P. A. Rydberg, 828.*

COLORADO: Fort Collins, 1895, *C. S. Crandall.*

INDIAN TERRITORY: Sapulpa, 1895, *B. F. Bush, 1249;* False Washita, 1868, *Edw. Palmer, 461.*

KANSAS: Riley Co., 1895, *J. B. Norton, 303;* Manhattan, 1887, *W. A. Kellerman;* Osborn Co., 1894, *C. L. Shear, 28;* Fort Riley, 1892, *E. E. Sayle, 452.*

NEBRASKA: Lincoln, 1887, *H. J. Webber;* Fort Niobrara, 1888, *T. E. Wilcox; Mrs. Austin;* Creete, *G. D. Sweezey.*

MISSOURI: St. Louis, 1843, *Riehl;* McDonald Co., 1891, *B. F. Bush.*

ILLINOIS: Oquawka, 1873, *H. N. Patterson.*

27. SENECIO NEO-MEXICANUS A. Gray, Syn. Fl. 1^2: 392. 1884

The original publication of this species is generally given as Proc. Amer. Acad. **19**: 55, but no description is there to be found. As far as I can find, the one in the Synoptical Flora is the first published. Probably more than one species is included in that description and in the specimens cited below there are apparently three different types, but it has been impossible for me to find any constant characters by which to distinguish them. In one of them the stem leaves are more or less lyrate-pinnatifid and even the basal ones occasionally have a few lobes on the petiole, while in the others the stem leaves are narrow and merely toothed. The tomentum is sometimes deciduous, sometimes almost persistent. It grows at an altitude of 1200–2500 m. [Plate 6, fig. 7.]

NEW MEXICO: Silver City, Pinos Altos Mts., 1880, *E. L. Greene;* between Santa Fe and Canoncito, 1897, *A. A. & E. Gertrude Heller, 3749;* Organ Mts., 1895, *E. O. Wooton; P. V. LeRoy.*

ARIZONA: Fort Huachuca, 1892, *T. E. Wilcox;* 1876, *E. Palmer, 614;* Santa Catalina Mts, 1883, *C. G. Pringle;* San Francisco Mts., 1881, *H. H. Rusby, 212;* Mogollon Mts., 1887, *E. A. Mearns, 58;* Squaw Creek, 1887, *E. A. Mearns, 171;* Santa Rita Mts., 1881, *C. G. Pringle.*

28. **Senecio salicinus** sp. nov.

A floccose perennial, with a short cespitose caudex: stems several, about 4 dm. high, simple below, striate and floccose: basal

leaves 5–10 cm. long, narrowly oblanceolate, the first ones subentire, but most of them serrate except at the tapering base, finely tomentose on both sides, but in age more glabrate above: stem leaves small, linear, sessile, dentate, slightly auricled at the base: cyme compound: the heads subumbellate at the ends of the branches, 7–8 mm. high, slightly floccose at the base: bracts yellowish, thin, lanceolate, shorter than the disk: rays light yellow, short and broad, 3–4 mm. long and 2 mm. wide: achenes striate, glabrous.

A species related to *S. Fendleri*, but characterized by the narrow, merely serrate basal leaves, the small subumbellate heads in a short, flat-topped inflorescence with widely spreading ultimate branches. It grows in the foothills at an altitude of about 1800 m. [Plate 6, f. 6.]

COLORADO: J. Laramie Co., 1895, *J. H. Cowen* (type in the herbarium of N. Y. Botanical Garden).

29. **Senecio canovirens** sp. nov.

Stout perennial with a short erect rootstock, dark green, floccose with more or less deciduous wool: stem 4–5 dm. high, loosely floccose: basal leaves 5–12 cm. long, short-petioled; blades lanceolate or oblanceolate, sinuately toothed, dark green, firmly floccose, in age almost glabrate above: lower stem leaves similar; upper ones linear, sinuately dentate with rather acute teeth: cyme with erect or ascending branches: heads 7–8 mm. high, turbinate campanulate; bracts 12–14, oblong, linear, floccose at the base and more or less villose, acute, brownish on the back and with yellowish margins: rays 5–6 mm. long and 2 mm. wide, at first orange, in age paler, 4-nerved: achenes glabrous, striate.

The type was determined by Prof. Greene as *Senecio Fendleri*, but it is very unlike the typical form of the aggregate that has been known under that name. The dark green color, the leaves which are merely toothed, never pinnatifid and still less bipinnatifid as they often are in *S. Fendleri* easily distinguish it from that species. The perennial caudex and rootstock are similar to that of *S. Fendleri* but less thick and less woody and, as far as seen from the specimens, not branched. It grows at an altitude of about 2000 m. [Plate 6, f. 9.]

NEW MEXICO: White Mountains, 1897, *E. O. Wooton, 244* (type in the herbarium of N. Y. Botanical Garden); Organ Mountains, *493*.

COLORADO: Pike's Peak, 1895, *Mrs. S. L. Clarke*.

SENECIO MUTABILIS Greene, Pittonia, **4**: 113. 1900

As I have seen no specimens of this species I have not been able to include it in my key. It may be the same as the preceding, but several characters given in the description do not agree with it, especially the deeply tridentate rays. Professor Greene is always criticizing other botanists for drawing vague descriptions. No better example of just such a description can be given than the one here made by himself.

30. **Senecio rosulatus** sp. nov.

Senecio aureus var. *Balsamitae* A. Gray, Proc. Acad. Nat. Sci. Phila. **1863**: 68, in part.

More or less tomentose perennial, with a branched rootstock and generally numerous underground stolons producing leafy offsets: stems 2–3 dm. high, floccose or sometimes becoming almost glabrate in age; first leaves of the offsets spatulate and entire; other basal leaves and lower stem leaves oblanceolate, finely white tomentose especially on the lower surface, occasionally becoming more glabrate in age, sinuately pinnatifid with rounded lobes, petioled: upper stem leaves lanceolate or linear, sessile, auricled at the base also with rounded lobes: cyme corymbiform, open: heads small, 5–6 mm. high, floccose at the base: bracts about 12, broadly lanceolate, acute, yellowish with rather broad membranous margins, much shorter than the disk: rays about 5 mm. long and 2 mm. wide, 4–5-nerved: achenes strongly striate, glabrous.

The species has been confused with *S. Fendleri*, but is distinguished by the more slender rootstock and the numerous branches forming offsets, the entire first leaves not seen in that species and the short rounded entire lobes of the stem leaves. The heads are usually also smaller. It grows at an altitude of 2500–4000 m. [Plate 6, f. 4, 4a.]

COLORADO: Georgetown, 1885, *N. H. Patterson 79* (type); Golden City, 1892, *E. L. Greene;* 1862, *Hall & Harbour, 333,* in part; 1871, *W. M. Canby;* Twin Lakes, 1873, *J. M. Coulter;* Pike's Peak, 1884, *G. W. Letterman, 260;* Caribou, 1891, *E. Penard, 228;* Fort Collins, 1896, *C. F. Baker;* Silver Plume, Gray's Peak, and Georgetown, 1895, *P. A. Rydberg.*

31. SENECIO FENDLERI Gray, Mem. Am. Acad. II, **4**: 108. 1849

The typical *S. Fendleri* is a rather rare plant with a decidedly woody rootstock and caudex. None of the specimens seen show

any sign of entire leaves nor of subterranean stolons. The leaves are often bipinnatifid or pinnatifid with oblong toothed, and acutish segments. See also the remarks given under *S. Nelsonii*. [Plate 6, f. 3.]

NEW MEXICO: Santa Fe Cañon, 1897, *A. A. & E. Gertrude Heller, 3774.*

COLORADO: 1873, *Brandegee, 546.*

UTAH: Salt Lake City, 1869, *S. Watson.*

Explanation of Plates

Unless otherwise stated, the drawings represent basal leaf, stem leaf selected a little above the middle of the stem and the head of each species. The leaves are reduced to one half and the heads are of natural size.

PLATE 5

1. *S. cymbalarioides* Nutt.
2. *S. acutidens* Rydb.
3. *S. pauciflorus* Pursh.
4. *S. flavovirens* Rydb.
5. *S. Jonesii* Rydb.
6. *S. subcuneatus* Rydb.
7. *S. fedifolius* Rydb.
8. *S. Greggii* Rydb.
9. *S. oblanceolatus* Rydb.
10. *S. pseudaureus* Rydb.
11. *S. millelobatus* Rydb.
12. *S. tridenticulatus* Rydb.
13. *S. crocatus* Rydb.
14. *S. sanguisoiboides* Rydb.
15. *S. compactus* (A. Gray) Rydb.

PLATE 6

1. *S. Nelsonii* Rydb.
2. *S. subnudus* DC.
3. *S. Fendleri* A. Gray.
4. *S. rosulatus* Rydb.

4*a*. An offset of the same.

5. *S. Idahoensis* Rydb.
6. *S. salicinus* Rydb.
7. *S. Neo-Mexicanus* A. Gray.
8. *S. platylobus* Rydb.
9. *S. canovirens* Rydb.
10. *S. longipetiolatus* Rydb. (from type).

10*a*. Basal leaf from *Baker, Earle & Tracy, 625.*

11. *S. multilobatus* Torr. & Gray.
12. *S. aurellus* Rydb.

12*a*. Lower stem leaf of the same.

13. *S. fulgens* Rydb.
14. *S. Plattensis* Nutt.
15. *S. nephrophyllus* Rydb.

A peculiar Case of contact Irritability

By F. Grace Smith

In connection with some experiments upon factors determining the radiation of shoots, several pots of bush-beans were grown in the dark. When the seedlings, perfectly etiolated, were about 20 inches high and had developed their first leaves, a peculiar adjustment was noticed in them. The petioles had arranged themselves in parallel planes. Another set of beans was planted in 6-inch pots, one pot kept in a black box, the control experiment in a propagating room of the greenhouse, which was lighted mostly from overhead but partly from the north. Each pot contained ten beans in sphagnum moss, planted in a circle, 2 cm. apart with the hypoctyl of each turned toward the center of the pot. The box, in which the experiment was carried on, was absolutely dark, except when the plants were watered and observed, a few minutes each day. In three weeks this parallel adjustment was seen in the pot kept in the dark (Fig. 1). There was but one exception in the eight seeds which germinated. No such adjustment could be seen in seedlings grown in light, or in succeeding experiments in the light.

Fig. 1.

To determine if this position was constant, other pots were planted in the same way, using eight seeds to a pot in most cases. Not every pot showed so large a proportion of petioles, in parallel planes but in almost every case more than three, usually four or five,

were in the same plane, whereas normally but two should be. In one pot all seven which germinated were in the same plane; in other cases five or six out of seven. Some in each pot had the epicotyl twisted, showing the adjustment was not the result of the position in which the seeds were planted. To investigate this more conclusively, sets of beans were planted in different ways.

(1) In a circle but with hypocotyl of each of the eight beans pointing in the same direction (Fig. 2). Of the six which had germinated on January 27th and unfolded their first leaves all were in the same plane (Fig. 3). January 30th, eight were large enough to be diagrammed; four were in the same plane, four others were in a plane at about an angle of 15° from this (Fig. 4).

(2) Twelve beans were planted in a cross, but with the hypocotyl of each turned in the same direction (Fig. 5). The resultant position is shown in Fig. 6. A 12-inch pot was used in this case.

(3) Nine beans were planted in a straight line, but with the hypocotyls turned in the same direction and toward each other (Fig. 7). The result is shown in Fig. 8. If a very large pot was used where no two seedlings could touch, there was no such adjustment (Fig. 9).

Other pots were planted with hypocotyl directed up or down, out or in, also with seeds on flatter surface and hypocotyls turned in different ways. There was no difference in the resultant positions. The position of planting, therefore, does not determine the adjustment, for good cases of parallelism in the petioles were found, whatever the original positions of the seeds. Therefore, the resultant plane is not brought about by internal causes, but is a response to external stimuli.

To test varying thermotropism and hydrotropism in the box, pots of beans were placed in different parts of the box. They continued to set their leaves in planes, bearing no constant relation to the sides of the box. Two pots also were placed in another case made of glass and darkened; one pot put on a clinostat revolving once in fifteen minutes, the other kept stationary. Of the eight beans which germinated on the clinostat six were in the same plane, although the leaves of one were not quite unfolded; one was not free from the cotyledons and one was at right angles.

The influence of the two stimuli, thermotropism and hydrotropism, must therefore be excepted.

Two pots were put into the same box with an electric fan keeping the air constantly in motion. The pot on the clinostat showed parallel adjustment very well (Fig. 10), also the stationary one (Fig. 11). The stillness of the air, therefore, makes no difference.

Chemotropism and hydrotropism, exerted by the leaves of neighboring seedlings, might furnish a stimulus but were not experimented with, because the stimulus to be described seemed sufficient to account for the phenomenon.

Of the mechanical forces, acting as irritable stimuli, pressure, strain and injury were not present, but certain observations made contact seem a possible factor and experiments were devised to test this.

Sets of beans were carefully matched and their positions plotted every other day. The plane of petioles and leaves was constantly changing but the final position was in a number of cases the position of the bean which first started from the cotyledon or at least the resultant position was the same for leaves which had been in contact. There was no chance for any contact in beans planted in 12-inch pots and the final positions showed no parallel adjustment.

Beans which were fully grown were placed so that the tip of the leaf of one seedling touched the leaf of another seedling. The diagrams 12, 13, 14 and 15 show the change of position.

The tendency as here shown is to take a parallel position. The movement is best seen when seedlings are not quite full grown. If contact can then change the position of the leaves, it must be possible to change the position at will. Paper leaves were fastened to standards and allowed to just barely touch the leaves of a seedling (Fig. 16, *a*). An angle of 25° was reached in all cases (Fig. 16, *b*). (Beans, kept in absolute darkness and watered by an outside tube did not unfold the plumule, but showed a movement of a quarter of an inch from the paper leaves.) Circumnutation alone, of course, could not bring about this definite fixed position.

Contact seems to work when light is present but is generally marked by the more noticeable light adjustment. One pot of

beans, planted in a circle, was kept revolving upon a clinostat in light. Fig. 17 shows the final position. The parallel adjustment was not so plain at first, but became more definitely marked with the growth of the seedlings.

One seedling of this set was kept, when the others were destroyed and was irritated by two leaves of thin mica, fastened to a stick placed in the pot. The whole thing was then revolved upon a clinostat. By this means the direct influence of heliotropism was neutralized and all shading from leaves was prevented. With each of three trials the seedling cotyledons moved one half inch from the artificial leaves.

Under ordinary circumstances of growth the plants experimented upon try to expose as much surface to the light as possible for photosynthesis. Heliotropism is the stimulus for this exposure, but, when light is withdrawn or, perhaps, during the night when growth is active, the plants must make use of some other stimulus to determine other positions. Contact is always present and is apparently the stimulus used by the plants. It is probable that this influence is a secondary one, acting in light as well as in darkness. The cases where currents of air were allowed to act upon the plants showed good adjustment, for by means of them the number of contacts of the leaves was increased.

Description of Figures

FIG. 1. Photograph showing parallel adjustment of petioles in bean seedlings grown in the dark.

FIGS. 2, 3, 4. Diagrams of positions of seeds as planted in Exp. I. and the resultant positions of petioles.

FIGS. 5, 6. Diagrams illustrating planting of seeds in Exp. II. and resultant positions of petioles.

FIGS. 7, 8. Diagrams illustrating 1st part of Exp. III.

FIG. 9. Diagram illustrating 2d part of Exp. III.

FIG. 10. Diagram of resultant positions of petioles in seedlings, grown in dark upon clinostat, acted upon by currents of air.

FIG. 11. Diagram of seedlings, grown in the dark and kept stationary, acted upon by currents of air.

FIGS. 12, 13, 14, 15. Diagrams of 4 examples of seedlings, whose leaves were placed in contact and the resultant changes in their positions.

FIG. 16. Diagram of seedlings, whose leaves were irritated by paper leaves and the consequent changes in their positions.

FIG. 17. Diagram of resultant position of petioles in seedlings, grown in light upon clinostat.

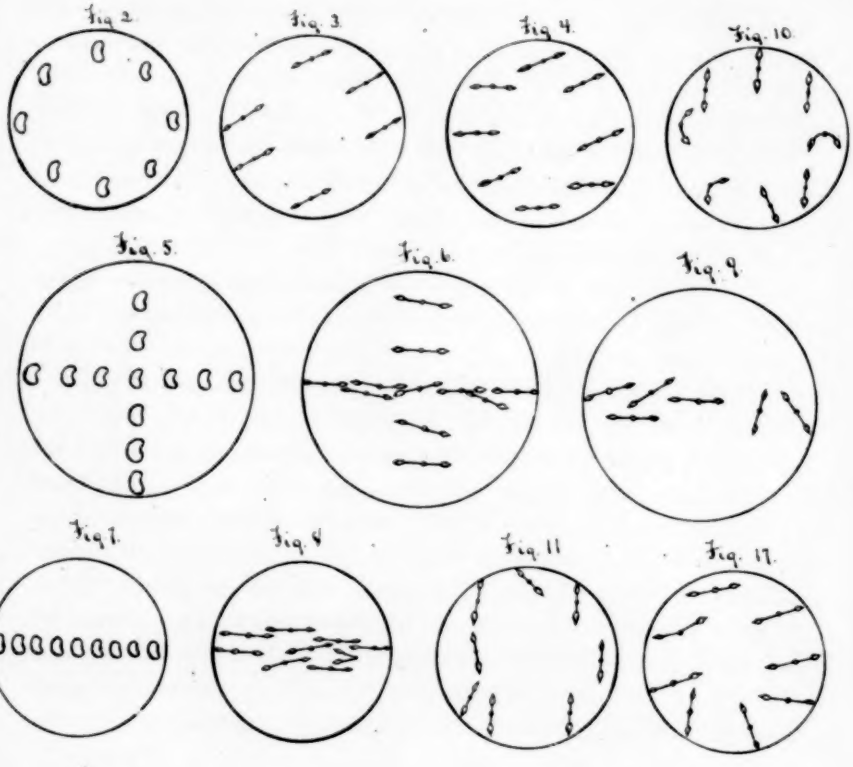
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 10.
Fig. 5.
Fig. 6.
Fig. 9.
Fig. 7.
Fig. 8.
Fig. 11.
Fig. 17.

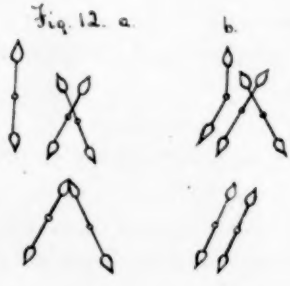
Fig. 12. a.
b.

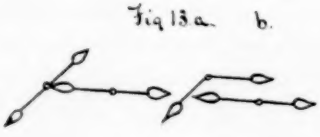
Fig 13 a.
b.

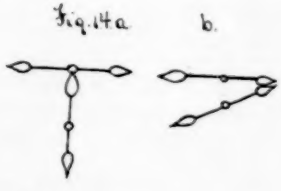
Fig. 14 a.
b.

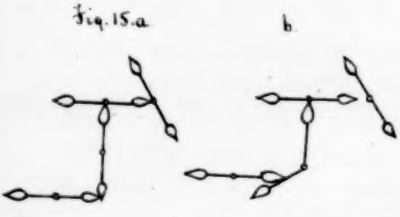
Fig. 15. a.
b.

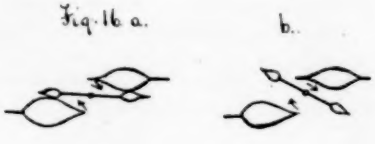
Fig. 16 a.
b.

What is Prunus insititia?

By P. A. Rydberg

In the February number of the *Botanical Gazette* Prof. Waugh says: "I am somewhat at a loss to understand the criticism which Dr. Rydberg offers in the December *Gazette* upon my conclusions regarding *Prunus insititia* Linn. as set forth in the *Gazette* of last June. He says: 'If Professor Waugh had said that *P. insititia* is the same as *P. domestica damascena* * * * I would have been the last to criticise.' This is precisely what I did say; and it is a conclusion upon which I still insist."

Prof. Waugh intentionally or unintentionally has omitted to cite the reasons that I gave for my statement. I added in my article in the December *Gazette*: "I have not the means to disprove the former." With the facilities that are afforded me by the combined libraries of Columbia University and the New York Botanical Garden and one of the largest herbaria found in America, I find myself unable to undertake the task, for it would require fieldwork done in Europe and access to all the literature on the subject. Prof. Waugh dared with much less facilities than I have to decide, as he says himself, 'that there is no such species as *P. insititia*,' notwithstanding the fact that nearly all European botanists hold a different opinion. The existence or non-existence of *P. insititia* as a species, and whether *P. insititia* and *P. domestica damascena* are the same or not, are questions that should be left to European botanists, who are much more able to settle these questions. I think that it is pretentious for an American to undertake such a work. American botanists have puzzles enough of their own to solve, so that they had better allow the Europeans to take care of their own flora. This is in plain words my criticism.

By leaving out initials, I have had the misfortune to be misinterpreted. When I said: "Koch, the acknowledged authority in Germany, recognized it," I meant, of course, William Daniel Joseph Koch, the great botanist, and not Karl Koch, the dendrologist. While the latter, perhaps, is better known in America on account of our lack of good general dendrologies, he has never

had the reputation of the older Koch and never can claim in the same sense the title, "the acknowledged authority." Professor Waugh's remark on Karl Koch having changed his opinion has therefore no bearing on my statement.

When I spoke of the non-existence of *P. insititia* in America I meant, of course, in the wild state. The existence of a plant in an orchard, garden, greenhouse or in a pot on the window-sill, is to me, as a pure and simple field botanist, the same as non-existence.

A new Asplenium, hitherto referred to A. Trichomanes var. incisum Moore*

By William R. Maxon

Asplenium vespertinum

Rhizome short, sub-erect, rootlets rather coarsely fibrous: stipes purplish brown, shining, closely tufted, slender, terete, from 1.2–3.5 cm. long; scales small, those at base of stipe dark, lance-acuminate, serrate, those above blackish, filiform, scattered or almost wanting: lamina linear, 7.5–22.5 cm. long: pinnae 20–30 pairs, sub-opposite to alternate, sub-sessile, oblong-linear to oblong, or even rhomboidal, somewhat reduced, reflexed and cordate-clasping below, the margins regularly and coarsely crenate-serrate, each lobe containing a simple vein; pinnae more or less auricled above at the base, the vein once or twice forked: sori rather short, 8–12 to the pinna, an odd one often borne on the auricle; indusium glabrous, regularly crenate; sporangia cinnamon-brown; annulus with 20 or more joints; spores dark brown, ovoid, the winged ridges rather closely reticulated.

Type specimen in the U. S. National Herbarium, no. 201581, collected on San Miguel Mountain, near National City, San Diego County, California, about Feb. 1, 1900, by Miss Laura F. Kimball of National City. Other specimens which I have examined and would refer to this species are the following:

In U. S. Nat. Herb.: no 299603, "San Diego, Cal., D. Cleveland"; nos. 238082, 311552, "Santa Ysabel (San Diego Co.), Cal., April 29, 1893, H. W. Henshaw"; no. 220713, "Near San Rafæl (Lower California), Mexico, April 13, 1882, Marcus E. Jones, 3749."

In herb. D. C. Eaton: "San Diego, Cal., Miss Barbeck, 1879;" "Near Poway, San Diego County, Cal., Wm. Stout, 1878;" "Tufts under rocks, Cajon Pass (San Bernardino County), near San Diego Mission, California, Nov. 9, 1857, Dr. Newberry;" "1881, C. C. Parry," probably collected in the vicinity of San Diego.

In herb. A. A. Eaton, Seabrook, N. H.: "Witch Creek, San

* Published by permission of the Secretary of the Smithsonian Institution.

Diego County, California, 1895, R. D. Alderson;" "San Miguel Mountain, San Diego County, Cal., Laura F. Kimball."

In herb. A. J. McClatchie, Phœnix, Arizona: "San Gabriel Mountains, near Pasadena (Los Angeles County), Cal., A. McClatchie."*

In herb. Sadie F. Price, Bowling Green, Ky.: "Rancho de la Nacion, near National City, Cal., 1892, L. F. Kimball."

Its range then extends from Los Angeles and San Bernardino Counties, Cal., southward into the peninsula of Lower California. Miss Kimball finds it under overhanging rocks in the smaller cañons, mostly where there is considerable moisture, though occasionally in situations more exposed to the sun.

My attention was first called to this excellent species by observing several sheets of it in the National Herbarium labeled *Asplenium Trichomanes incisum* Moore. Upon examining Moore's figure of the variety *incisum*,† I was convinced that they were by no means referable to this variety; and a subsequent examination of typical *incisum* contributed by Moore to the Eaton Herbarium confirmed this belief. Since the Pacific coast "*incisum*" seems altogether distinct from any previously described species, I have ventured to assign to it the specific name *vespertinum*, in allusion to its distribution on the western coast.

The variety *incisum* of Moore is nothing more than an extremely foliose, deeply incised form of the common maidenhair spleenwort, comparable to the variety *cambricum* of *Polypodium vulgare*, and like that variety always sterile. The only true *incisum* I have seen from the United States is that collected by Mr. C. C. Frost, near West Brattleboro, Vermont, in 1874, fronds of which are preserved in the Eaton Herbarium and in the private herbarium of Dr. A. J. Grout. They agree closely with typical material of *incisum* and are not to be distinguished from it. Mr. A. A. Eaton has sent me specimens of *A. Trichomanes*, collected in Tennessee by Mr. J. H. Ferris, which show considerable approach toward *incisum*, but which, together with some fronds from Bethany, West Virginia, collected by Mr. G. Guttenberg in 1877, and preserved in the Eaton Herbarium, are merely incised forms of typical *A. Trichomanes*.

* Recorded by A. J. McClatchie, Erythea, **2**: 76. 1894.

† Thomas Moore, Nat. Pr. Brit. Ferns, **2**: 102. *pl.* 76. *f. A.* 1859.

Professor Eaton figures, as var. *incisum* Moore, one of Frost's fronds, but he remarks that this variety "is frequently collected near San Diego, Cal., where the type [*A. Trichomanes*] does not seem to occur" and adds that "it has slightly larger fronds and pinnae somewhat less incised."* As stated, it appears that *A. Trichomanes* does not occur in southern California; and how the material which *does* occur there could be referred to the var. *incisum* is hard to comprehend. Some of the stouter specimens of *vespertinum* in general appearance bear a certain resemblance to *Asplenium blepharodes* Eaton, described † from Lower California; but the long jointed cilia, which thickly fringe the indusium of that species, at once distinguish it from *vespertinum*, in which the indusium is smooth and merely crenate. In addition, *vespertinum* invariably has the pinnae much more coarsely serrate; and its sori are short, of a light color, and number from 6–12 (13), while *blepharodes* bears from 6–8 larger, more oblique sori. The spores of *vespertinum* appear to be more closely reticulated than those of *blepharodes*, and the winged ridges slightly narrower. The spores of both species present striking differences from those of *Trichomanes*, in which the winged ridges are greatly reduced or apparently lacking and the surface warty-puncticulate or papillose. The most noticeable feature, however, distinguishing *vespertinum* from *Trichomanes*, is the constancy of the coarse serrations of the pinnae.

In conclusion I desire to extend my thanks to those who have kindly loaned me specimens for study, to Professor L. M. Underwood and Mr. C. L. Pollard for a number of suggestions and references, and especially to Miss Laura F. Kimball for the excellent living plants of this species now growing in the Botanical Garden in this city and from which the greater part of the specific description has been drawn.

U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

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* Eaton, Ferns N. Am. 1: 271, 273, 274. *pl. 36. f. 3.* 1879.

† D. C. Eaton, Zoe, 1: 197. *pl. 7.* 1890. The type specimen, in Herb. D. C. Eaton, has been kindly loaned me by Professor A. W. Evans.

Autumnal Coloration of Leaves

By G. E. Stone

At the meeting of the Society for Plant Morphology and Physiology held at Columbia University in December, 1899, a paper by Dr. D. T. MacDougal was read entitled "Influence of Inversions of Temperature and varietal Currents of Air upon the Distribution of Plants."

The observations upon which the results were obtained were made in Arizona, and among other things brought out in this paper was the fact that the autumnal colorations of leaves first showed itself on the low elevations.

During a brief discussion of the paper some other observers took exception to this statement, and it was stated that in the Allegheny region the autumnal tints first showed themselves upon the mountains, or higher elevations.

Our observations here in Massachusetts have coincided with those of Dr. MacDougal in Arizona, namely that the autumnal tints are first seen in the lowlands and not upon the hills and mountains. Whether there exists a different state of affairs in the Alleghenies which causes autumnal coloration to appear first upon the higher elevation, thus offering an exception to the condition of affairs in New England and Arizona would be well worth knowing.

According to our experience the first trees to show color are the red maple and poison sumac of the swamps. These species, on account of their location, are subject to the frosts when those in the highlands are not, and this factor alone would hasten their coloration.

There are, however, many external influences which determine coloration in trees which should be taken into consideration.

The exceedingly dry season of '95–'96 caused many upland trees to exhibit premature coloration on account of drought, and in like manner did the wet season of '97 cause many swamp species to show their tints as early as the middle of August on account

of extreme moisture. No two seasons seem to give rise to the same intensity of coloration. During seasons when there are no extreme differences in temperature intense scarlet colorations are lacking; on the other hand marked difference in temperature gives rise to an intense coloration of a great variety. The duration of coloration is also equally variable. Some seasons the color has a long period of duration while in others it is brief. The past season was one in which the transformation from green to yellow, scarlet and brown, and subsequent fall of the leaf was brief in the Connecticut Valley, a feature which, according to the writer, was hastened by excessive cloudy weather and rainfall during the period of transformation. The work of borers is also an important factor in the premature coloration of white and sugar maple trees. Borers however are generally confined to one or more limbs and the premature coloration of these, while the rest of the tree may still be green, is of common occurrence and they can be readily picked out at a glance.

In fact any abnormal condition of the limbs or tree whether brought about by insects or fungus intrusion or from purely physiological disorders are capable of giving rise to premature coloration in the leaves, which to the pathologist possess interest.

A Revision of the North American Species of the Genus Eleutera Beauv. (Neckera Hedw.)

By Stephen Conrad Stuntz

This work on the genus *Eleutera* was begun at the suggestion of Dr. C. R. Barnes, now of the University of Chicago, carried on in the Herbarium of the University of Wisconsin, and completed under the direction of Dr. R. H. True.

Thanks are due to the authorities of the following herbaria for loans of material in this genus—Herbarium of the Canadian Geological Survey, Herbarium of Columbia University, and the National Herbarium; to Dr. Julius Röll and M. Jules Cardot for specimens unobtainable in this country; to Dr. R. A. Harper for assistance in obtaining material; to Mrs. E. G. Britton and Dr. E. L. Greene for assistance in bibliographical details; to Dr. Barnes for helpful comment and criticism; and to Dr. True for general aid and advice.

There is a tendency among bryologists to begin with Hedwig, Muscorum Frondosorum, 1792, for purposes of nomenclature, but it has seemed best to adhere strictly to the rules adopted by the Madison Botanical Congress. Changes necessitated by the adoption of Hedwig as a starting point are noted.

ELEUTERA Beauv. Prodr. 30. 1805

(Neckeria Hedw. Fund. Musc. **2**: 93. 1782. Not Scopoli, Introd. 313. 1777.

Neckera Hedw. Musc. Frond. **3**: 52. 1792.

Eleuteria Beauv. Prodr. 56. 1805.

Cryptopodia Röhl. Deutsch. Fl. **3**: 82. 1813.

Neckera Distichia Brid. Bryol. Univ. **2**: 238. 1827.

Euneckera C. M. Syn. **2**: 41. 1850.

Distichia C. M. Flora, **73**: 489. 1890.)

Gametophyte large, spreading, on trunks of trees and rocks: primary stems short, creeping, often stoloniferous: secondary stems erect or pendent, pinnately or bi-pinnately branched: branches complanate, sometimes flagelliform: leaves complanate,

usually transversely undulate, glossy: outer perichaetial leaves ovate, inner long-acuminate: cells rhomboidal at apex, becoming oblong at middle, and linear-oblong or sinuous at base, smooth: alar cells rounded-quadrate. *Sporophyte:* capsule immersed or exserted, symmetrical: calyptra cucullate: peristome double: teeth 16, lance-linear, closely articulate, thin: endostome a short basal membrane, 16-cleft, without cilia: annulus none. (From Greek *Eleuthera*, epithet applied to Diana.)

The genus includes 158 species; according to Paris, Index Bryologicus, distributed throughout the temperate zones and tropics.

The generic name, *Neckeria* of Hedwig, afterwards written *Neckera*, given in honor of N. J. Necker, the German bryologist, was antedated by *Neckeria* Scopoli, given to what is now known as *Corydalis* or *Capnoides*. In 1805 Palisot de Beauvois, in his *Prodrome des cinquième et sixième familles de l'Aethéogamie*, divides Hedwig's and Bridel's *Neckera* into *Neckera* and *Pilotrichum*, (generic characterizations and lists of included species on pp. 35 and 37), and, on p. 30 he gives "*Eleutera*" as a substitute for *Neckera*, which he would abolish because of its being given in honor of a man; on p. 56, in the "Table des Mousses," he gives "*Eleuteria. Eleuterie* (common name). Nom que je propose de donner au genre Neckera." This, in connection with the lists of species on pp. 35 and 77–8 amounts to generic publication, although no binomials were published. In his generic characterizations, and also under *Neckera* in "Table des Mousses," he gives "*Eleutrie*" as the common name which he proposes for the genus.

The genus *Eleutera* differs from the nearest North American genus, *Homalia*, in having narrow, not distinctly keeled segments, and no annulus.

The total number of North American species of the genus is six. Two of the species are sub-tropical; one of these is limited to Florida; the other occurs in Florida, Texas and New Mexico. Two species are northwestern, occurring from Alaska to northern Idaho and central California. One is limited to the Alleghanies. The remaining species, or one of its two varieties, is distributed from Newfoundland to Lake Athabasca and the Rocky Mountains, south to North Carolina, and in New Mexico (Fendler). All the species except the sub-tropical ones, which are found only on trees, grow on both trees and rocks.

No North American specimens of *E. fontinaloides* (*N. pumila*) have been seen, and it is likely that Bruch and Schimper were wrong in crediting it to North America. *N. Ludoviciae* and *N. cymbifolia* are referable to *Pilotrichum*, as is probably *N. Floridana* also, although all the specimens examined bearing this name in herbaria are really *E. disticha*.

Synopsis of the Species

Leaves acute or acuminate.	
Spinulose.	1. *E. Douglasii.*
Not spinulose.	2. *E. pennata.*
Leaves rounded or lingulate, apiculate or abruptly acuminate.	
Leaves undulate.	
Costa ⅓ length of leaf or less.	
Delicate, branched.	2a. *E. pennata oligocarpa.*
Robust, simple.	2b. *E. pennata pterantha.*
Costa ⅔ length of leaf.	
Long, loose, flagellate.	3. *E. Menziesii.*
Short, soft, no flagella.	3a. *E. Menziesii limnobioides.*
Leaves plane.	4. *E. ornithopodioides.*
Leaves obtuse.	
Base of leaves unsymmetrical, costa far to one side.	5. *E. disticha.*
Base of leaves symmetrical.	6. *E. Jamaicensis.*

1. **Eleutera Douglasii** (Hooker) nom. nov.

Gametophyte loosely spreading or pendent, pale or yellowish-green: primary stems 3–4 cm. long: secondary stems 10–20 cm., pinnately branched: branches long, attenuate to apex: leaves lanceolate-acuminate, spinulose at apex, wavy at base, thin, glossy, ecostate: dioicous: outer perichaetial leaves ovate, acute, denticulate at apex, inner leaves lanceolate, acute, reaching to base of capsule or rarely higher. *Sporophyte:* capsule oval, reddish-brown, becoming chestnut, entirely exserted: lid long-rostrate, oblique: teeth yellow, articulate: segments equaling teeth, the latter not divided between articulations. (In honor of David Douglas (1798–1834), an early northwestern collector, who collected the species on the Columbia River.)

Type locality, Columbia River.

Trees and shaded rocks, Alaska, Vancouver Island and Coast Range, B. C., east to Lake Pend d'Oreille, Idaho, south to San Mateo Co., California.

Syn.: Neckera Douglassii Hooker, Bot. Misc. **1**: 131. *pl. 35.* 1830. *Neckera Douglasii Macounii* Kdbg. Bull. Torr. Club, **17**: 275. 1890.

Illus.: Hooker, l. c.

Exsic.: Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 394; Macoun, Can. Musc. 88, 104, 200, 241, 389 (var. *Macounii*); Ren. & Card. Musc. Am. Sept. Exsic. 77, 77*b*; Röll, 410, 411.

The Kindbergian variety, *Macounii*, described as having a turgid-oval capsule exserted on long pedicel and leaves less attenuate, cannot stand, as none of the specimens so labeled in the herbaria examined agree with the printed description or differ materially from Hooker's original description. Lesquereux and James' description of the species is incorrect in several minor details.

2. **Eleutera pennata** (L.) nom. nov.

Gametophyte bright green, glossy, large, spreading: primary stems short: secondary stems 7–10 cm., irregularly pinnate, sometimes simple: branches usually obtuse, sometimes attenuate: leaves narrowly ovate-lanceolate, acuminate, entire or sometimes denticulate above: costa indistinct, bifid or single: cells small, thin, at apex elongated-rhomboidal, at middle and base linear, sinuous, at angles irregularly quadrate: monoicous: outer perichaetial leaves short, ovate-acuminate, inner long-acuminate, entire, exceeding the capsule. *Sporophyte:* capsule, large, oval-oblong, reddish-brown, immersed: calyptra small, whitish, covering lid only: lid conical, short-beaked: teeth linear-subulate, connected at tips, densely articulate, irregularly divided: segments imperfect. (From Latin *pennata*, furnished with wings.)

Type, European.

On trees and rocks. Newfoundland and Nova Scotia, south in mountains to North Carolina, west to Manitoba; Mexico (Bescherelle).

Syn.: Muscus terrestris major, ramulis compressis, foliis superficie crispis Vaill. Bot. Par. 129. *pl. 27. f. 4.* 1727. *Sphagnum pennatum undulatum, vagina squamosa* Dill. Hist. Musc. 250. *pl. 32. f. 9.* 1741. *Sphagnum cauliferum et ramosum, foliis crispis, crebris per caulem capitulis* Hall. Enum. Stirp. Helv. 96. *pl. 3. f. 2.* 1742. *Fontinalis pennata* L. Sp. Pl. 1371. 1763. *Hypnum pennatum* Hall. Stirp. Helv. 1297. *pl. 45. f. 2.* 1768. *Weisia pennata* Schrank, Bayer. Fl. **2**: 445. 1789. *Neckera pennata* Hedw. Musc. Frond. **3**: 47. *pl. 19.* 1792. *Filotrichum pennatum* Beauv. Prodr. 83. 1805. *Cryptopodia pennata* Röhl. Deutsch. Fl. **3**: 82.

1813. *Daltonia pennata* W. Arn. Disp. 54. 1825. *Neckera Distichia pennata* Brid. Bryol. Univ. **2**: 238. 1827.

Illus.: Vaill. l. c.; Dill. l. c.; Hall. l. c.; Hedw. l. c.; Funck, Deutsch. Moose, *pl. 34. f. 1*; Schmied. Icon. Pl. Man. **3**: *pl. 58. f. 2*; Grev. Scot. Crypt. Fl. *pl. 109*; Hooker & Taylor, Musc. Brit. Supp. *pl. 4*; Bruch & Schimp. Bryol. Eur. *pl. 440*; Wilson, Bryol. Brit. *pl. 34. f.*; Sull. Musc. & Hep. U. S. *pl. 5*; Lesq. & James, Manual, *pl. 5*.

Exsic.: Drummond, Musc. Bor. Am. 161; Sull. Musc. Allegh. 76; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 266, (Ed. 2) 392; Aust. Musci App. 255; Ren. & Card. Musc. Am. Sept. Exsic. 188; Macoun, Can. Musci, 80, 239, 345, 584, 654, 666, 794. In Herbarium University of Wisconsin, Sull. & Lesq. 266 and 392 of the different editions are the same, the number 392 being pasted over the number 266 on the original packet.

2a. **Eleutera pennata oligocarpa** (Bruch) nom. nov.

Gametophyte small, delicate, pale green: primary stems short: secondary stems 2–5 cm., slender, irregularly pinnate: branches attenuate to apex, sometimes flagelliform: paraphyllia none: leaves lingulate, abruptly acuminate, deeply undulate, subserrate at apex: costa short or indistinct: cells rhomboidal at apex, at base and middle linear, at edges quadrate or rounded: outer perichaetial leaves ovate-acuminate, inner narrow-acuminate, ecostate, exceeding the capsule. *Sporophyte:* capsule small, reddish-yellow: calyptra large: lid orange, short-beaked: teeth lance-linear, densely articulate: segments imperfect. (From Greek *oligos*, few, and *karpos*, fruit.)

Type, European.

Trees and rocks. Prince Edward Island, west to Lake Athabasca and the Rocky Mountains in British America, south to the Catskills; Santa Fé, New Mexico (Fendler).

Syn.: *Neckera pumila* Wahlenb. Fl. Lapp. 367. n. 653. 1812; not *N. pumila* Hedw. *Neckera oligocarpa* Bruch, Mscr. in Hartm. Skand. Fl. 338. 1849. (5th ed.) *Neckera pennata β tenera* C. M. Syn. **2**: 50. 1850. *Neckera intermedia* Theden. in sched. *Neckera chlorocaulis* Sull. & Lesq. Musc. Bor. Am. (Ed. 1) *268*.

Illus.: Bruch & Schimp. Bryol. Eur. *pl. 441*.

Exsic.: Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 268 (as *N. chloro-*

caulis), (Ed. 2) 393; Aust. Musc. App. Supp. I., 528; Macoun, Can. Musci, 240, 797, 892.

2b. **Eleutera pennata pterantha** (C. M. & Kindb.) nom. nov.

Gametophyte: secondary stems nearly simple, about 1 dm. in length, rigid and robust, erect: one branch of costa often reaching to the middle of leaf: paraphyllia numerous. *Sporophyte:* capsule emergent. (From Greek *pteros*, wing, and *anthos*, flower.)

Type locality, rocks, Hector, B. C., the only locality from which it has been collected.

Syn.: Neckera oligocarpa var. *pterantha* Kdbg. in Herb. Can. Geol. Survey.

Neckera pterantha C. M. & Kindb. in Macoun, Cat. Can. Pl. Musci, 162. 1892.

Exsic.: Macoun, Can. Musci, 105, 494.

In case we begin with Hedwig, 1792, for nomenclature, the initial "L." in the species should be replaced by "Hedw."

On the original label in Herb. Can. Geol. Survey in what I take to be Kindberg's writing, the name of the variety is given as *pterantha;* for this reason that name is adopted instead of *peterantha*, which is evidently a slip, and quite meaningless.

All gradations occur between the species and what has been known as *N. oligocarpa*, so that we must recognize that as a mere variety. These slight and varying differences were recognized by C. F. Austin, who, on a label in the Columbia University Herbarium, says: "I am unable to find a single distinct *permanent* character for distinguishing between *oligocarpa* and *pennata*." Some of these gradations are: Coarse plants with very narrow leaves and attenuate branches; very robust plants with lingulate leaves; delicate plants with obtuse branches and narrow leaves.

Eastern American specimens of the var. *oligocarpa* agree with European specimens in having no paraphyllia, but specimens from Vermilion Lake, Minn., west to the Rocky Mountains have a few paraphyllia, tending toward var. *pterantha*.

3. **Eleutera Menziesii** (Drumm.) nom. nov.

Gametophyte large, yellowish-green, brown when old: primary stems 8–10 cm.: secondary stems 5–25 cm. in length, flat, densely pinnately branched: branches 1–10 cm., becoming flagellate at

apex, often covered with lateral filiform flagella, forming a dense brush: leaves oblong, lingulate, apiculate or sometimes obtuse, undulate: more or less regularly denticulate half way to base: costa ½–⅔ length of leaf: cells at apex irregularly rhomboidal, at middle and base narrow-oblong: dioicous: perichaetial leaves small, long-acuminate, denticulate, costate to apex: cells linear. *Sporophyte:* capsule reddish-brown, immersed or emergent, seta length of capsule: calyptra with few hairs or none: lid oblique, acute: teeth slender, nodose, articulate: segments very slender, split between the few articulations. (In honor of Archibald Menzies (1754–1842), who collected the species in the Rocky Mountains.)

Type locality, Rocky Mountains.

On trees and rocks. Alaska and Vancouver Island to Banff and Flathead Lake, Montana, south to Yosemite and Russian Valleys and Marion Co., California.

Syn.: Neckera Menziesii Drummond, Musc. Bor. Am. 162. *Neckera Menziesii* Hook. in Drumm. Musc. Bor. Am. (Ed. 1) 162 (according to Paris, Ind. Bryol. 853). *Neckera Menziesii amblyclada* Kindb. in Macoun, Cat. Can. Pl. Musci, 162. 1892.

Illus.: Sull. Icon. Musc. Suppl. *pl. 62.*

Exsic.: Drumm. Musc. Bor. Am. 162 type; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 395; Macoun, Can. Musci, 106, 111, 169, 198, 238, 397, 796, 567 (var. *amblyclada*), 253, 927 (var. *eflagellosa*), 94 (approaching var. *limnobioides*); Röll, 496, 497.

3a. **Eleutera Menziesii limnobioides** (Ren. & Card.) nom. nov.

Gametophyte small, cespitose, soft and dilated, brownish-green: secondary stems but 1–2 cm. in length: habit of a *Limnobium;* no flagella. (From *Limnobium*, and *oidos*, like.)

Type locality, Mt. Hood, Oregon.

Rocks, Cascades, Easton, Washington; Mt. Hood, Oregon.

Syn.: Neckera Menziesii limnobioides Ren. & Card. Bot. Cent. **44**: 422. 1890.

There is no material difference between the so-called variety *amblyclada* and the species, the leaves on the same plant varying in length and in length of costa. As to flagella, all the specimens seen have more or fewer flagella.

Paris in Index Bryologicus 853, gives Hooker as the author of

the species, but Drummond's original label in Herbarium Can. Geol. Survey gives description, and Hooker himself, Bot. Misc. **1**: 132, speaks of it as described by Drummond.

4. **Eleutera ornithopodioides** (Scop.) nom. nov.

Gametophyte small, soft, yellowish-green: secondary stems slender, 2–4 cm. in length, pendent, pinnately divided into short tapering branches, which are sometimes flagellate: leaves plane, unsymmetrical at base, elliptical, sharply and strongly apiculate, minutely serrulate at tip: costa short, indistinct: cells at tip rhomboidal, at middle and base linear, at angles very short and irregular: dioicous: perichaetial leaves narrow, long. *Sporophyte:* capsule small on long slender seta: lid narrowly oblique, rostrate, teeth pale, narrow: segments short from an enlarged base. (From *ornithos*, bird, *pous*, foot, *oidos*, like.)

Type, European.

Rocks, Newfoundland, south in mountains to Tennessee; rare.

Syn.: Muscus trichomanoides filicifolius splendens Vaill. Bot. Par. 139. *pl. 23. f. 4.* 1727. *Hypnum pennatum, compressum et splendens, capsulis ovatis* Dill. Hist. Musc. 268. *pl. 34. f. 7.* 1741. *Hypnum ornithopodioides* Scop. Fl. Carn. 164 1760. *Hypnum complanatum* L. Sp. Pl. 1588. 1763. *Leskia complanatum* Hedw. Fund. Musc. **2**: 93. *pl. 10. f. 62–65.* 1782. *Leskea Omalia complanata* Brid. Bryol. Univ. **2**: 327. 1827. *Neckera complanata* Hüb. Muscol. Germ. 576. 1832. *Homalia complanata* de Not. Epil. 199. 1869.

Illus.: Vaill. l. c.; Dill. l. c.; Hedw. l. c.; Smith & Sowerby, Eng. Bot. *pl. 1492;* Funck, Deutsch Moose, *pl. 35. f. 1;* Bruch & Schimper, Bryol. Eur. *pl. 444;* Wilson, Bryol. Brit. *pl. 24b.*

Exsic.: Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 267, (Ed. 2) 396.

All the American specimens seen are sterile; sporophyte description taken from European specimens.

In case Hedwig, 1792, is taken as starting point for nomenclature, replace "*ornithopodioides* (Scop.)" by "*complanta* (Hedw.)."

5. **Eleutera disticha** (Sw.) nom. nov.

Gametophyte small, soft, pale green: primary stems short: secondary stems 1–3 cm. in length, narrow, irregularly pinnate:

branches short: leaves broadly lingulate, rounded at apex, somewhat undulate, unsymmetrical, costa far to one side: tip somewhat wavy, minutely serrulate: costa slender, ¾ length of leaf: cells irregularly massed at tip, oblong at middle, narrowed at base: synoicous: outer perichaetial leaves ovate-acuminate, apical cells roughly triangular, basal and middle sinuous: inner perichaetial leaves narrow-acuminate, equaling or exceeding the capsule serrulate at apex, with narrow, sinuous cells. *Sporophyte:* capsule, immersed, or sub-emergent, urn-shaped: calyptra small, smooth; lid conical-acute, oblique: teeth pale, narrow lance-subulate, minutely wrinkled: segments equaling teeth, not keeled. (From Greek *distichos*, two-rowed.)

Type, West Indian.

Trees, coasts of Florida and throughout tropical America.

Syn.: Fontinalis disticha Sw. Pr. Fl. Ind. Occ. 138. 1788. *Neckera disticha* Hedw. Musc. Frond. **3**: 53. *pl. 22.* 1792. *Pilotrichum distichum* Beauv. Prodr. 83. 1805. *Pilotrichum truncatum* Beauv. Prodr. 83. 1805. *Daltonia disticha* W. Arn. Disp. 54. 1825. *Neckera Distichia retusa* Brid. Bryol. Univ. **2**: 243. 1847.

Illus.: Hedw. l. c.

Exsic.: Aust. Musc. App. Supp. I., 530.

This species is easily distinguished from the nearest North American species, *E. Jamaicensis*, by its smaller, very unsymmetrical leaves, as well as by its more slender stems and smooth calyptra.

Replace the "(Sw.)" by "(Hedw.)" if Hedwig be taken as the starting-point for nomenclature.

6. **Eleutera Jamaicensis** (Gmel.) nom. nov.

Gametophyte soft, yellowish-green: primary stems short: secondary stems short, 1–2 cm. in length, usually simple: leaves distichous, auriculate-clasping on the one side, nearly symmetrical, oblong-lingulate, truncate, transversely undulate, very minutely serrulate: costa slender, 4/5 length of leaf: cells at tip small and irregularly massed, in middle oblong, at base narrow: synoicous: outer perichaetial leaves ovate, abruptly acuminate, inner narrow, linear, ecostate or short-costate, sub-serrulate, equaling the capsule. *Sporophyte:* capsule small, sessile, cylindrical-oblong, immersed: calyptra small, covering lid only, with few hairs; lid conical, oblique, short-beaked: teeth and segments free to base, nodulose, punctulate. (From Latin, *of Jamaica.*)

On trees, western and southern Florida, Texas (Wright). New Mexico, and throughout tropical America.

Syn.: Sphagnum pennatum undulatum, vagina pilosa Dill, Hist. Musc. 294. *pl. 32. f. 8.* 1741. *Hypnum Jamaicensis* Gmel. L. Syst. Nat. 1341. 1791. *Neckera undulata* Hedw. Musc. Frond. **3**: 51. *pl. 21.* 1792. *Fontinalis crispa* Sw. Prodr. Fl. Ind. Occ. 138. 1788. *Pilotrichum undulatum* Beauv. Prodr. 83. 1805. *Daltonia undulata* W. Arn. Disp. 54. 1825. *Neckera Distichia undulata* Brid. Bryol. Univ. **2**: 241. 1827. *Neckeropsis undulata* Reichardt in Novara Exp. Bot. **1**: 181. 1871.

Illus.: Dill. l. c.; Hedwig l. c.; Bridel, Musc. Recent. **2**: *pl. 3. f. 21.*

Exsic.: Aust. Musc. App. Supp. I., 529.

Replace "*Jamaicensis* (*Gmel.*)" by "*undulata* (*Hedw.*)" if Hedwig, 1792, is taken as a starting-point.

UNIVERSITY OF WISCONSIN.

Proceedings of the Club

TUESDAY EVENING, FEBRUARY 13, 1900

President Brown in the chair. Eighteen persons present.

Dr. Rusby reported on the part of the Committee on Excursions an interesting field-day at Maplewood, N. J., with kind hospitalities enjoyed by the courtesy of Miss Idalette Carpenter, of Maplewood.

President Brown announced the Committees for the year 1900 as follows:

Committee on Finance, J. I. Kane, C. F. Cox; Committee on Admissions, Cornelius Van Brunt, Jeannette B. Greene, M.D., John K. Small, Ph.D.; Committee on Library and Herbarium, Per Axel Rydberg, Ph.D., Marie L. Sanial, Helen M. Ingersoll, Alice M. Isaacs; Committee on the Local Flora, Professor N. L. Britton, Ph.D.; Phanerogamia, Eugene P. Bicknell, H. H. Rusby, M.D., Rev. Geo. D. Hulst; Cryptogamia, Professor L. M. Underwood, Marshall A. Howe, Ph.D., Mrs. Elizabeth G. Britton; Committee on Excursions, Dr. L. Schoeney, Marie L. Sanial, Eugene Smith, George V. Nash, W. A. Bastedo; Committee on Program, Dr. H. H. Rusby, Dr. C. C. Curtis, Mrs. Elizabeth G. Britton.

The scientific program consisted of a paper by Dr. H. H. Rusby entitled "The Tendency of entomophilous Flowers to antero-posterior Irregularity." The paper was copiously illustrated by blackboard drawings, and its comparative review of floral irregularity in the various orders was aided by the distribution of printed lists with statistics.

The object of the paper was to show the distribution among and within the families of plants of cases of irregularity specially favoring insect-pollination. In this view, several types of irregularity were excluded from consideration as not having such origin. One such is irregularity in an ovary, as reflected in the fruit of *Mango*. Another is the necessary curving forward of such sessile flowers as those of *Piper*, closely pressed against, or even buried

in their rachis. Still another is the enlargement of one perigone-segment, to act as a scale, and in its absence, to protect the flower of a catkin, spike or other dense inflorescence, as seen in some species of *Eriocaulon*.

Other forms of irregularity, those with which the paper had properly to deal, were classified and shown to represent different degrees of modification. The lowest form was regarded as the simple curving upward of a horizontal or declined androecium or gynaecium, as seen in *Mirabilis*. The next involved an accompanying curvature of perigone, as in *Cyrtanthus*, then successively an oblique base or mouth, as in many Gesneriaceae, the distinction of the tube in varying degrees, as seen in the same family, the exaggeration or reduction of the anterior or posterior portion of the limb, as in *Chioscographia* or *Pteropetalon*, and in bilabiate corollas, the arrangement of such corollas to form radiant inflorescences, as in many Umbelliferæ, variations in size as well as direction of anterior and posterior stamens, as in *Cassia*, and numerous forms of appendaging.

These forms were traced among the Monocotyledons and Dicotyledons respectively. None were found among the 21 lowest of the 43 families of Monocotyledons. Of the 10 next highest, 5 show none, 4 show slight or doubtful forms, while the highest, Liliaceae, with 197 genera, twice as many as the other 9 families combined, shows, amidst general regularity a few highly irregular genera, two of them simulating Orchidaceous forms. Of the 12 highest families, only 3 are regular. Five of the highest 6 are very irregular indeed, the highest, Orchidaceae, phenomenally so. It thus appears that an increased tendency to irregularity is indicative of higher development, but it is liable to occur in families and groups of families usually distinguished for its absence.

This principle was then shown to be even more clearly illustrated by the Dicotyledons. In the 53 lowest families, but 4 show irregularity. Only 1 of these is found among the first 39, and this is Aristolochiaceae, with a single irregular genus. Among the next 120 families, 27 show irregularity, and these are rather uniformly distributed among the others. Then come 19, several showing slight irregularity and one very irregular indeed. The next 17 are, with one exception, highly irregular, one of them

however, being so in only a few of its genera. The 11 highest families are very peculiar.. While mostly regular, some of them are noted for irregularity, but this is so peculiarly adjusted in the inflorescence as to bring about the condition of regularity so far as the latter is concerned. Thus the daisy, while an inflorescence, is essentially a regular flower, by virtue of the arrangement of its irregular florets. It is also noticeable that as these ray flowers are usually pistallate, this arrangement reverses the position, so far as the head if concerned, of the distinctively pistillate portion. The various types of irregularity in composite flowers were discussed, and these were contrasted with other families exhibiting radiant inflorescences.

It was pointed out that irregularity was not a fundamental characteristic, but was readily called into existence by the exigencies of any group, or even species, and might be expected to develop anywhere. Special attention was called as illustrating this principle, to the marked irregularity of *Cotyledon gibbiflorum* and *Saxifraga sarmentosa*, species in notably regular genera. It was also noted as significant that the most irregular families, such as Leguminosae, might have extensive series of genera perfectly regular: also that almost exactly equal forms of irregularity might develop in families most widely separated, as the Liliaceae and the Capparidaceae. The fact that irregularity is more frequent in the higher families of the two classes is due to the fact that the essential property of such families is a greater power of adaptation, floral irregularity being only one manifestation of this character.

EDWARD S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

This Index is intended to include (1) Titles of all papers and books relating to American plants; (2) All papers on botanical subjects by American botanists; (3) Papers of special interest relating to physiological or morphological subjects wherever published. Botanists can aid greatly in this matter by the contribution of separates of their papers especially those published outside the usual botanical journals, such as the publications of learned societies, experiment station bulletins and reports, and journals only occasionally containing botanical matter.

The titles are reprinted monthly on standard library cards of two widths, and are sold to subscribers at the price of one cent per card.

The editors will welcome any notice of omitted titles or other suggestions relative to the greater efficiency of the Index. Address all matter relating to the Index to The Torrey Botanical Club, Columbia University, New York City.

Arthur, J. C., & Stuart, W. Corn Smut. Rep. Indiana Agric. Exp. Sta., **12**: 84–135. *pl. 10–13*. F. 1900.

Averill, C. K. The Distribution of certain Trees and Shrubs in Western Connecticut. Rhodora, **2**: 34–38. Feb. 1900.

Beal, W. J. Notes on *Cabomba Caroliniana* A. Gray. Bull. Torr. Club, **27**: 86. 14 F. 1900.

Beal, W. J. Some Monstrosities in Spikelets of *Eragrostis* and *Setaria*. Bull. Torr. Club, **27**: 85, 86. 17 F. 1900.

Becker, K. *Cereus Peruvianus* Mill. Monatsch. für Kakteenkunde, **10**: 6. 15 Ja. 1900. [Illust.]

Bessey, C. E. One thousand Miles for a Fern. Asa Gray Bull. **8**: 2–6. F. 1900.

Brainerd, E. The Blackberries of New England. Rhodora, **2**: 23–29. F. 1900.

Mentions 13 species and varieties. *Rubus sativus* (Bailey) Brainerd raised from *R. nigrobaccus sativus* Bailey.

Brainerd, E. Typical *Goodyera repens* in New England. Rhodora, **2**: 22. Ja. 1900.

Burt, E. A. *Russula emetica* in Vermont. Rhodora, **2**: 71–73. Mh. 1900.

Camerarius, R. J. Das Geschlecht der Pflanzen. Leipzig, 1899.

Canby, W. M. *Coreopsis involucrata* on the Atlantic Coast. Rhodora, **2**: 34. F. 1900.

Carleton, M. A. Russian Cereals adapted for Cultivation in the United States. Bull. U. S. Dept. Agric. (Div. Bot.), 23: 1–42. *pl. 1, 2. f. 1, 2.* 1900.

Churchill, J. R. An unusual Form of *Drosera*. Rhodora, **2**: 70, 71. *pl. 15. f. 8.* M. 1900.

Clarke, C. B. Cyperaceae. Symb. Antillanae, **2**: 8–160. 15 Ja. 1900.

Descriptions of all West Indian species; many new.

Clendenin, I. Botanical Teaching in secondary Schools. Asa Gray Bull. **8**: 6–13. F. 1900.

Cockerell, T. D. A. Notes on some Southwestern Plants. Bull. Torr. Club, **27**: 87–89. 17 F. 1900.

Collins, F. S. Notes on Algae—II. Rhodora, **2**: 11–14. Ja. 1900.

One new variety and three new forms described.

Collins, F. S. Preliminary Lists of New England Plants—V. Marine Algae. Rhodora, **2**: 41–52. F. 1900.

Day, M. A. The local Floras of New England (Addenda). Rhodora, **2**: 73, 74. Mh. 1900.

Earle, F. S. Some Florida Fungi. Bull. Torr. Club, **27**: 120–123. 24 Mh. 1900.

New species in *Asterina*, *Lembosia*, and *Leptothyrium*.

Eastwood, A. Key and Flora [to Bergen's Elements of Botany]. Rocky Mountain Edition, 1–139. 1900.

Eggleston, W. W. Further Notes on the Distribution and Host Plants of *Arceuthobium pusillum*. Rhodora, **2**: 9, 10. Ja. 1900.

Eggleston, W. W. *Hudsonia ericoides* in New Hampshire. Rhodora, **2**: 22. Ja. 1900.

Eggleston, W. W. *Polymnia Canadensis* in Vermont. Rhodora, **2**: 70. Mh. 1900.

Ellis, J. B., & Everhart, B. M. New Species of Fungi from various Localities with Notes on some published Species. Bull. Torr. Club, **27**: 49–64. 17 F. 1900.

New species in *Corticium*, *Hymenochaete*, *Zygodesmus*, *Mucronoporus*, *Dacryomyces*, *Asterina*, *Melanomma*, *Amphisphaeria*, *Teichospora*, *Schizostoma*, *Mycosphaerella*, *Leptosphaeria*, *Thyridium*, *Hysterographium*, *Hypoderma*, *Phyllosticta* (2), *Phoma*, *Rhabdospora*, *Dothiorella*, *Sphaeropsis* (2), *Diplodia*, *Ascochyta*, *Stagonospora*, *Camarosporium*, *Septoria* (3), *Kellermania*, *Cylindrosporium*, *Pestalozzia*, *Diplocladium*,

Hadrotrichum, *Pilacre*, *Exosporium*, *Dasyscypha*, *Pyrenopeziza*, *Haematomyxa* and *Puccinia*.

Evans, A. W. A new Genus of Hepaticae from the Hawaiian Islands. Bull. Torr. Club, **27**: 97–104. *pl. 1.* 24 Mh. 1900.

Acromastigum nov. gen.

Fernald, M. L. *Arceuthobium pusillum* in the St. John and St. Lawrence Valleys. Rhodora, **2**: 10, 11. Ja. 1900.

Fernald, M. L. Is *Artemisia Stelleriana* a native of New England? Rhodora, **2**: 38–40. F. 1900.

Fernald, M. L. Re-discovery of *Eleocharis diandra*. Rhodora, **2**: 60. Mh. 1900.

Fernald, M. L. Some Northeastern Species of *Scirpus*. Rhodora, **2**: 15–21. Ja. 1900.

S. pedicellatus, *S. atratus*, and *S. rubrotinctus*, sp. nov. *S. pedicellatus pullus*, *S. atrocinctus grandis*, *S. rubrotinctus confertus*, and *S. sylvaticus Bissellii*, var. nov. *S. cyperinus condensatus* and *S. cyperinus Andrewsii*, nom. nov.

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Greenman, J. M. New Species and Varieties of Mexican Plants. Proc. Am. Acad. **35**: 307–315. 16 Mh. 1900.

New species in *Spiranthes*, *Hosackia*, *Stemmadenia*, *Physalis*, *Lamourouxia*, *Coreopsis*, *Spilanthes*, *Dysodia*, and *Lygodesmia*.

Haberer, J. V. *Eleocharis diandra* in Central New York. Rhodora, **2**: 61. Mh. 1900.

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Harper, R. M. Further Additions to the Flora of Amherst. Rhodora, **2**: 68–70. Mh. 1900.

Holm, T. Catalogue of Plants collected by Messrs. Schuchert, Stein and White on the East Coast of Baffin's Land and West Coast of Greenland. Bull. Torr. Club, **27**: 65–68. 17 F. 1900.

Holmberg, E. L. Una critica sobre "La Flora Argentino." Anal. Soc. Cien. Argentina, 48: 257–293. N. 1899.

Hyams, C. W. The Flora of North Carolina from Ranunculaceae to Salviniaceae. Bull. N. C. Agric. Exper. Sta. 164: 289–365. 1899.

Jack, J. G. *Arceuthobium pusillum* in Massachusetts. Rhodora, **2**: 6–8. *pl. 13.* Ja. 1900.

Jones, L. R. *Arceuthobium pusillum* on a new host in Vermont. Rhodora, **2**: 8, 9. *pl. 14.* Ja. 1900.

Kofoid, C. A. A preliminary Account of some of the Results of the Plankton Work of the Illinois Biological Station. Science, II. **11**: 255–258. 16 F. 1900.

Kurtz, F. Essai d'une Bibliographie botanique de l'Argentine. Bol. Acad. Nac. Ciencias de Cordoba, **16**: 117–208. 1900. [Separate, pp. 1–91.]

Leavitt, R. G. The Relation of certain Plants to atmospheric Moisture. Rhodora, **2**: 29–32. F. 1900; 63–68. Mh. 1900.

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Patterson, F. W. Some woody Fungi. Asa Gray Bull. **8**: 13–19. F. 1900.

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New species in *Campylopus* (2), *Leptodontium*, *Mielichhoferia*, *Bryum* (2), *Mnium*, *Garovaglia* and *Papillaria* from Mexico and Costa Rica.

Rich, W. P. The Heather in New England. Rhodora, **2**: 53, 54. Mh. 1900.

Robinson, B. L. New Phanerogams, chiefly Gamopetalae, from Mexico and Central America. Proc. Amer. Acad. **35**: 323–342. 16 Mh. 1900.

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Rothrock, J. T. Post Oak, Iron Oak, Barrens White Oak (*Quercus stellata* Wang.). Forest Leaves, **7**: 104. F. 1900. [Illust.]

Rusby, H. H. An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886, XXIX. Bull. Torr. Club, **27**: 69–84. 17 F. 1900.

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Ruellia (2), *Lepidagathis*, *Aphelandra* (2), *Pseuderanthemum*, *Justicia* (2), *Jacobinia*, *Citharexylon*, *Aegiphila*, *Clerodendron* and *Bystropogon*.

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Schrenk, H. von. Notes on *Arceuthobium pusillum*. Rhodora, **2**: 2–5. *pl. 12*. Ja. 1900.

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C. apiculata, *gibbosa*, *hispida*, *leucopila*, *Australiensis*, *macrosperma*, *villosissima*, and various new combinations in this and allied genera.

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Stone, G. E. The Walking Fern in Worcester County, Massachusetts. Rhodora, **2**: 14. Ja. 1900.

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